CHAPTER 34

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE
NONE				

CHAPTER 34

NAVIGATION

LIST OF EFFECTIVE PAGES

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	2	Jun 15/96	
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	8	Jun 15/96	
	9	Jun 15/96	
	10	Jun 15/96	
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	9	May 15/88	
	10	May 15/88	
	11	May 15/88	
	12	Jun 15/93	
	13	Jun 15/93	
	14	Jun 15/93	
	15	Dec 15/95	
	16	Jun 15/93	
	17/18	Jun 15/93	
34-conts	1	May 15/85	
R 34-conts	2	Jun 15/96	
34-conts	3	Dec 15/95	
34-conts	4	Dec 15/95	
34-conts	5	Dec 15/95	
34-conts	6	Dec 15/95	
34-conts	7	Dec 15/95	
34-conts	8	Dec 15/95	
34-conts	9	Dec 15/95	
34-conts	10	Dec 15/95	
34-conts	11	Dec 15/95	
34-conts	12	Dec 15/95	
34-conts	13	Dec 15/95	
34-conts	14	Dec 15/95	
34-conts	15	Dec 15/95	
34-conts	16	Dec 15/95	
34-DIAGM	1	Jul 15/84	
34-DIAGM	2	Jul 15/84	
34-DIAGM	3	May 15/85	
34-DIAGM	4	Jul 15/84	
34-DIAGM	5	Jul 15/84	
34-DIAGM	6	Jul 15/84	
34-DIAGM	7	Jun 15/95	
34-DIAGM	8	Jun 15/95	
34-DIAGM	9	Jun 15/95	
34-DIAGM	10	Jun 15/95	
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34-DIAGM	16	Jun 15/95	
34-DIAGM	17	Jun 15/95	
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34-DIAGM	19	Jun 15/95	
34-DIAGM	20	Jun 15/95	
34-DIAGM	21	Jun 15/95	
34-DIAGM	22	Jun 15/95	
34-DIAGM	23	Jun 15/95	
34-DIAGM	24	Jun 15/95	
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34-INDEX	1	Nov 15/86	
34-INDEX	2	Jun 15/95	
34-INDEX	3	Jun 15/95	
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34-INDEX	7	Jun 15/95	
34-INDEX	8	Jun 15/95	
34-INDEX	9	Jun 15/95	
34-INDEX	10	Jun 15/95	
34-INDEX	11	Jun 15/95	
34-INDEX	12	Jun 15/95	
34-INDEX	13	Jun 15/95	
34-INDEX	14	Jun 15/95	
34-INDEX	15	Nov 15/82	
34-INDEX	16	Nov 15/82	
34-INDEX	17	May 15/87	
34-INDEX	18	Nov 15/82	
34-INDEX	19	Dec 15/95	
34-INDEX	20	Jun 15/95	
34-INDEX	21	Jun 15/95	
34-INDEX	22	Jun 15/95	
34-INDEX	23	Jun 15/95	
34-INDEX	24	Jun 15/95	
34-INDEX	25	Jun 15/95	
34-INDEX	26	Jun 15/95	
34-INDEX	27	Jun 15/95	
34-INDEX	28	Jun 15/95	
34-INDEX	29	Jun 15/95	
34-INDEX	30	Jun 15/95	
34-INDEX	31	Jun 15/95	
34-INDEX	32	Jun 15/95	
34-INDEX	33	Jun 15/95	
34-INDEX	34	Jun 15/95	
34-INDEX	35	Jun 15/95	
34-INDEX	36	Jun 15/95	
34-INDEX	37	Jun 15/95	
34-INDEX	38	Jun 15/95	
34-INDEX	39	Jun 15/95	
34-INDEX	40	Jun 15/95	
34-INDEX	41	Jun 15/95	
34-INDEX	42	Jun 15/95	
34-INDEX	43	Jun 15/95	
34-INDEX	44	Jun 15/95	
34-INDEX	45	Jun 15/95	
34-INDEX	46	Jun 15/95	
34-INDEX	47	Jun 15/95	
34-INDEX	48	Jun 15/95	
34-INDEX	49	Jun 15/95	
34-INDEX	50	Jun 15/95	
34-INDEX	51	Jun 15/95	
34-INDEX	52	Jun 15/95	
34-INDEX	53	Jun 15/95	
34-INDEX	54	Jun 15/95	
34-INDEX	55	Jun 15/95	
34-INDEX	56	Jun 15/95	
34-INDEX	57	Jun 15/95	
34-INDEX	58	Jun 15/95	
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34-00-00	3	Dec 15/91	
34-00-00	4	May 15/75	
34-00-00	5	Aug 15/81	
34-00-00	6	Mar 15/83	
34-00-00	7	May 15/82	
34-00-00	8	Jun 15/80	
34-00-01	101	May 15/82	
34-00-01	102	Mar 15/83	
34-00-01	103	Mar 15/81	
34-00-01	104	Mar 15/81	
34-00-01	105/106	Aug 15/82	
34-00-01	107/108	Mar 15/83	
34-00-01	109	Mar 15/83	
34-00-01	110	Mar 15/83	
34-00-01	111	Mar 15/83	
34-00-01	112	Mar 15/83	
34-00-01	113/114	Mar 15/83	
34-00-01	401	Aug 15/73	
34-00-01	402	Nov 15/73	
34-00-01	501	Mar 15/80	
34-00-01	502	Mar 15/80	
34-10-00	1/2	Dec 15/80	
34-13-00	1	Mar 15/91	
34-13-00	2	Dec 15/80	
34-13-00	3	Mar 15/91	
34-13-00	4	Mar 15/91	
34-13-00	5	Dec 15/80	
34-13-00	6	Mar 15/91	
34-13-00	201	Jul 15/83	
34-13-00	202	Mar 15/84	
34-13-00	203	Mar 15/84	
34-13-00	204	Mar 15/84	
34-13-00	205	Mar 15/84	
34-13-00	206	Mar 15/84	
34-13-00	207/208	Mar 15/84	
34-13-00	501	May 15/85	
34-13-00	502	May 15/85	
34-13-00	503	Dec 15/91	
34-13-00	504	May 15/85	
34-13-00	505	May 15/85	
34-13-00	506	May 15/85	
34-13-00	507	May 15/85	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
34-13-00	508	May 15/85	
34-13-00	509	May 15/85	
34-13-00	510	May 15/85	
34-13-00	511	May 15/85	
34-13-00	512	May 15/85	
34-13-00	513	May 15/85	
34-13-00	514	May 15/85	
34-13-01	401	Nov 15/81	
34-13-01	402	Dec 15/79	
34-13-01	403	Dec 15/79	
34-13-01	404	Nov 15/81	
34-13-01	405/406	Nov 15/81	
34-13-01	601	Jun 15/80	1
34-13-01	602	Jun 15/80	1
34-13-01	601	May 15/82	2
34-13-01	602	May 15/82	2
34-13-01	603	Jun 15/80	2
34-13-01	604	May 15/82	2
34-13-01	605	Nov 15/84	2
34-13-01	606	Nov 15/84	2
34-13-01	607	Nov 15/84	2
34-13-01	608	Nov 15/84	2
34-13-01	609/610	Jul 15/84	2
34-13-02	401	Nov 15/74	
34-13-02	402	Mar 15/80	
34-13-02	601	Jun 15/92	
34-13-02	602	Jun 15/92	
34-13-03	401	Aug 15/82	
34-13-03	402	Aug 15/78	
34-13-04	401	May 15/85	
34-13-04	402	Aug 15/78	
34-14-00	1	Nov 15/84	
34-14-00	2	Aug 15/82	
34-14-00	3/4	Nov 15/82	
34-14-00	5/6	Nov 15/82	
34-14-00	7	May 15/89	
34-14-00	8	Nov 15/84	
34-14-00	9	Nov 15/84	
34-14-00	10	Nov 15/84	
34-14-00	11	Nov 15/84	
34-14-00	12	Dec 15/91	
34-14-00	13	Nov 15/84	
34-14-00	14	Nov 15/84	
34-14-00	15	Aug 15/82	
34-14-00	16	Nov 15/84	
34-14-00	17	Nov 15/84	
34-14-00	18	Dec 15/91	
34-14-00	19	Dec 15/91	

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34-14-00	20	Dec 15/91	
34-14-00	21	Dec 15/91	
34-14-00	22	Dec 15/91	
34-14-00	23	Dec 15/91	
34-14-00	24	Dec 15/91	
34-14-00	25	May 15/89	
34-14-00	26	May 15/89	
34-14-00	101	Nov 15/82	
34-14-00	102	Jun 15/95	
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34-14-00	113	Jul 15/84	
34-14-00	114	Jul 15/84	
34-14-00	115	Jul 15/84	
34-14-00	116	May 15/85	
34-14-00	117	May 15/85	
R 34-14-00	118	Jun 15/96	
34-14-00	119/120	Jun 15/95	
34-14-00	121/122	Jun 15/95	
34-14-00	123/124	Jun 15/95	
34-14-00	125/126	Jun 15/95	
34-14-00	127/128	Jun 15/95	
34-14-00	129/130	Jun 15/95	
34-14-00	131/132	Jun 15/95	
34-14-00	133/134	Jun 15/95	
34-14-00	135/136	Jun 15/95	
34-14-00	137/138	Jun 15/95	
34-14-00	139	Jun 15/95	
34-14-00	140	Jun 15/95	
34-14-00	141/142	Jun 15/95	
34-14-00	143/144	Jun 15/95	
34-14-00	145/146	Jun 15/95	
34-14-00	147/148	Jun 15/95	
34-14-00	149/150	Jun 15/95	
34-14-00	151/152	Jun 15/95	
34-14-00	153/154	Jun 15/95	
34-14-00	155/156	Jun 15/95	
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34-14-00	159/160	Jun 15/95	
34-14-00	201	Jul 15/83	

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	34-14-00	203	Jul 15/83	
	34-14-00	204	Aug 15/81	
	34-14-00	205/206	Aug 15/81	
R	34-14-00	501	Jun 15/96	
R	34-14-00	502	Jun 15/96	
R	34-14-00	503	Jun 15/96	
R	34-14-00	504	Jun 15/96	
R	34-14-00	505	Jun 15/96	
R	34-14-00	506	Jun 15/96	
R	34-14-00	507	Jun 15/96	
R	34-14-00	508	Jun 15/96	
R	34-14-00	509	Jun 15/96	
R	34-14-00	510	Jun 15/96	
R	34-14-00	511	Jun 15/96	
R	34-14-00	512	Jun 15/96	
R	34-14-00	513	Jun 15/96	
R	34-14-00	514	Jun 15/96	
	34-14-00	515	Nov 15/89	
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	34-14-00	517	Dec 15/94	
	34-14-00	518	Dec 15/94	
	34-14-00	519	Dec 15/94	
	34-14-00	520	Dec 15/94	
	34-14-00	521/522	Dec 15/94	
	34-14-01	401	Aug 15/82	1
	34-14-01	402	Aug 15/82	1
	34-14-01	403	Aug 15/82	1
	34-14-01	404	Dec 15/95	1
	34-14-01	401	May 15/89	2
	34-14-01	402	Dec 15/95	2
	34-14-01	403/404	Aug 15/82	2
	34-14-03	401	Aug 15/81	
	34-14-03	402	May 15/75	
	34-14-04	201	May 15/85	
	34-14-04	202	May 15/85	
	34-14-04	401	Aug 15/81	
	34-14-04	402	May 15/75	
	34-14-05	401	Aug 15/81	
	34-14-05	402	Aug 15/78	
	34-14-06	401	May 15/89	
	34-14-06	402	May 15/89	
	34-14-06	403	May 15/82	
	34-14-06	404	May 15/82	
	34-14-06	405/406	May 15/89	
	34-14-08	401	Aug 15/78	
	34-14-08	402	Dec 1/71	
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	34-15-00	104	Nov 15/84	
	34-15-00	105	May 15/87	
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	34-15-00	503/504	Jul 15/84	
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	34-15-01	402	May 15/73	
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	34-16-00	102	Nov 15/82	
	34-16-00	103	Nov 15/82	
	34-16-00	104	Aug 15/82	
	34-16-00	105	Jul 15/83	
	34-16-00	106	Aug 15/82	
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	34-16-00	109	May 15/85	
	34-16-00	110	Nov 15/83	
	34-16-00	111	May 15/85	
	34-16-00	112	Aug 15/82	
	34-16-00	113	May 15/85	
	34-16-00	114	Aug 15/82	
	34-16-00	115	Aug 15/82	
	34-16-00	116	May 15/85	

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34-16-00	118	Aug 15/82	
34-16-00	119	Aug 15/82	
34-16-00	120	Aug 15/82	
34-16-00	121/122	Aug 15/82	
34-16-00	123/124	Aug 15/82	
34-16-00	125/126	Aug 15/82	
34-16-00	127/128	Jul 15/83	
34-16-00	129/130	Aug 15/82	
34-16-00	131/132	Jul 15/83	
34-16-00	133/134	Aug 15/82	
34-16-00	135/136	May 15/85	
34-16-00	137/138	Aug 15/82	
34-16-00	501	May 15/89	
34-16-00	502	Dec 15/80	
34-16-00	503	Feb 15/82	
34-16-00	504	May 15/89	
34-16-01	401	May 15/85	
34-16-01	402	Dec 1/71	
34-16-02	401	Jul 15/83	
34-16-02	402	May 15/73	
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34-19-00	121/122	Dec 15/91	
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34-19-00	131/132	Dec 15/91	
34-19-00	133/134	Mar 15/91	
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34-19-00	139/140	Dec 15/95	
34-19-00	141/142	Dec 15/95	
34-19-00	143/144	Dec 15/95	
34-19-00	145/146	Dec 15/95	
34-19-00	147/148	Dec 15/95	
34-19-00	149/150	Dec 15/95	
34-19-00	151/152	Dec 15/95	
34-19-00	201/202	Dec 15/92	
R 34-19-00	501	Jun 15/96	
R 34-19-00	502	Jun 15/96	
R 34-19-00	503	Jun 15/96	
R 34-19-00	504	Jun 15/96	
R 34-19-00	505	Jun 15/96	
R 34-19-00	506	Jun 15/96	
34-19-01	401	Jun 15/92	
34-19-01	402	Dec 15/92	
34-19-01	403/404	Mar 15/91	
34-19-02	401	Mar 15/91	
34-19-02	402	Mar 15/91	
34-19-02	403/404	Mar 15/91	
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34-21-00	5/6	Mar 15/91	
34-21-00	7	Mar 15/91	
34-21-00	8	May 15/82	
34-21-00	9	Mar 15/91	
34-21-00	10	Mar 15/91	
34-21-00	11	Dec 15/91	
34-21-00	12	Mar 15/91	

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34-21-00	13	Aug 15/81	
34-21-00	14	Mar 15/91	
34-21-00	15	Dec 15/91	
34-21-00	16	Dec 15/91	
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34-21-00	102	May 15/89	
34-21-00	103	Mar 15/81	
34-21-00	104	Mar 15/81	
34-21-00	105	Aug 15/81	
34-21-00	106	Aug 15/81	
34-21-00	107	Nov 15/84	
34-21-00	108	Aug 15/81	
34-21-00	109/110	Aug 15/81	
34-21-00	111/112	Aug 15/81	
34-21-00	113/114	Aug 15/81	
34-21-00	115/116	Aug 15/81	
34-21-00	117/118	Aug 15/81	
34-21-00	119/120	Aug 15/81	
34-21-00	121/122	Mar 15/91	
34-21-00	123/124	Nov 15/84	
34-21-00	125/126	Nov 15/84	
34-21-00	127/128	Nov 15/84	
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34-21-00	211/212	Mar 15/84	1
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34-21-00	203	Mar 15/84	2
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34-21-00	501	Jul 15/84	2
34-21-00	502	Jul 15/84	2
34-21-00	503/504	May 15/86	2
34-21-04	401	Mar 15/91	
34-21-04	402	Dec 15/80	
34-21-04	403/404	Mar 15/91	
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34-21-07	201	Aug 15/81	
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34-22-00	121/122	Mar 15/83	

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34-33-04	401	Nov 15/87	
34-33-04	402	Nov 15/87	
34-33-04	403/404	Nov 15/87	

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NAVIGATION

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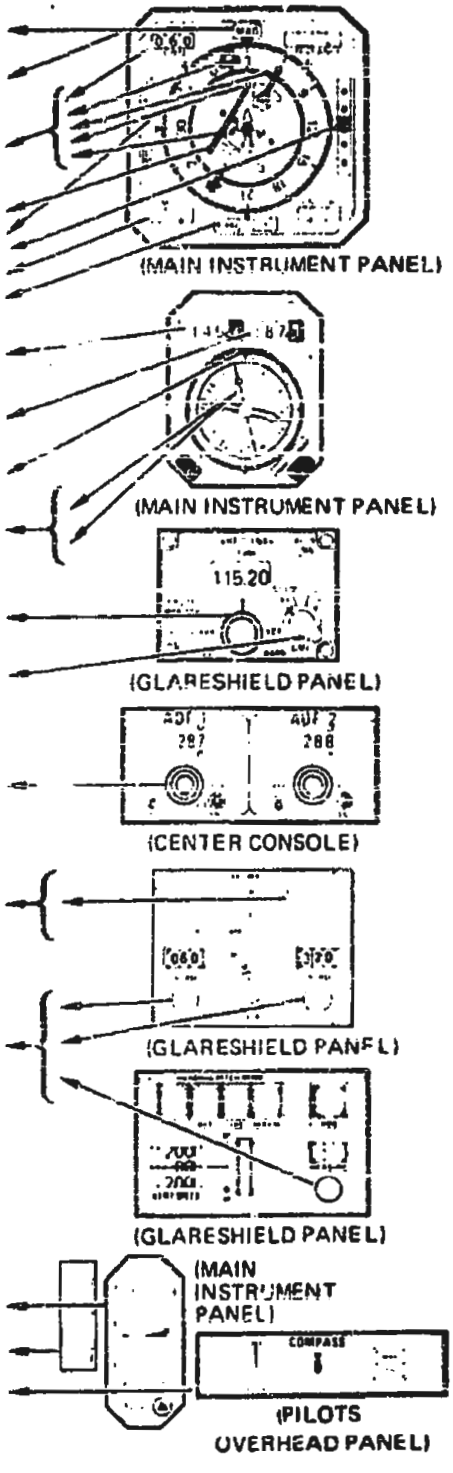
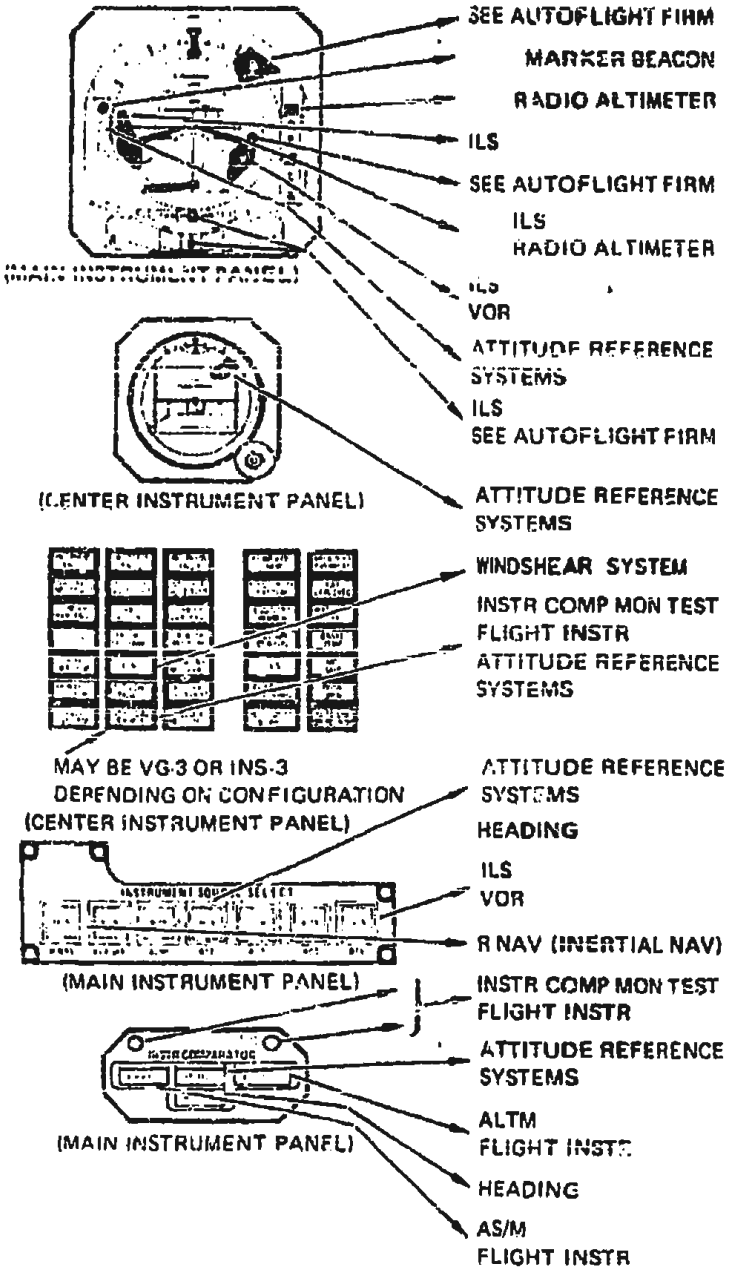


NAVIGATION CONTENTS



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M1-0001-34-7039

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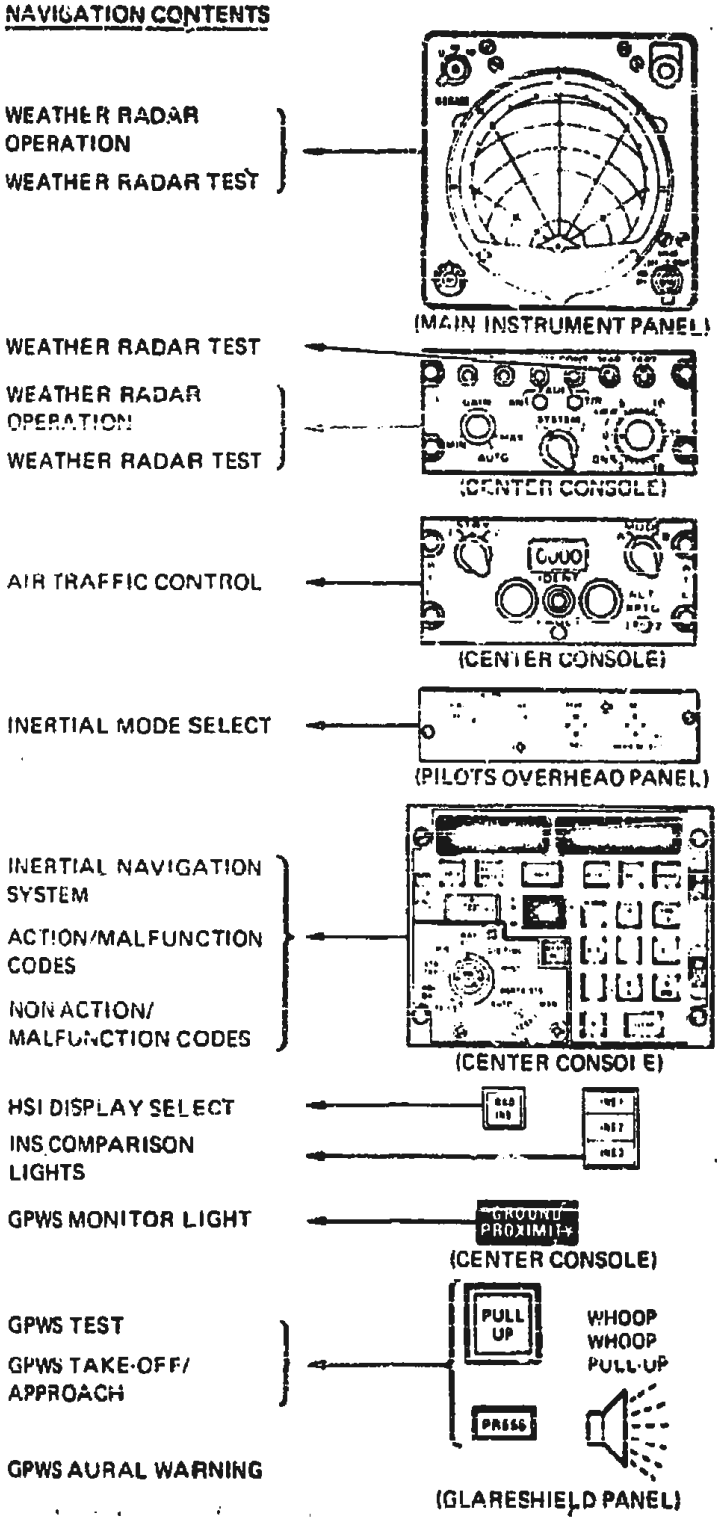
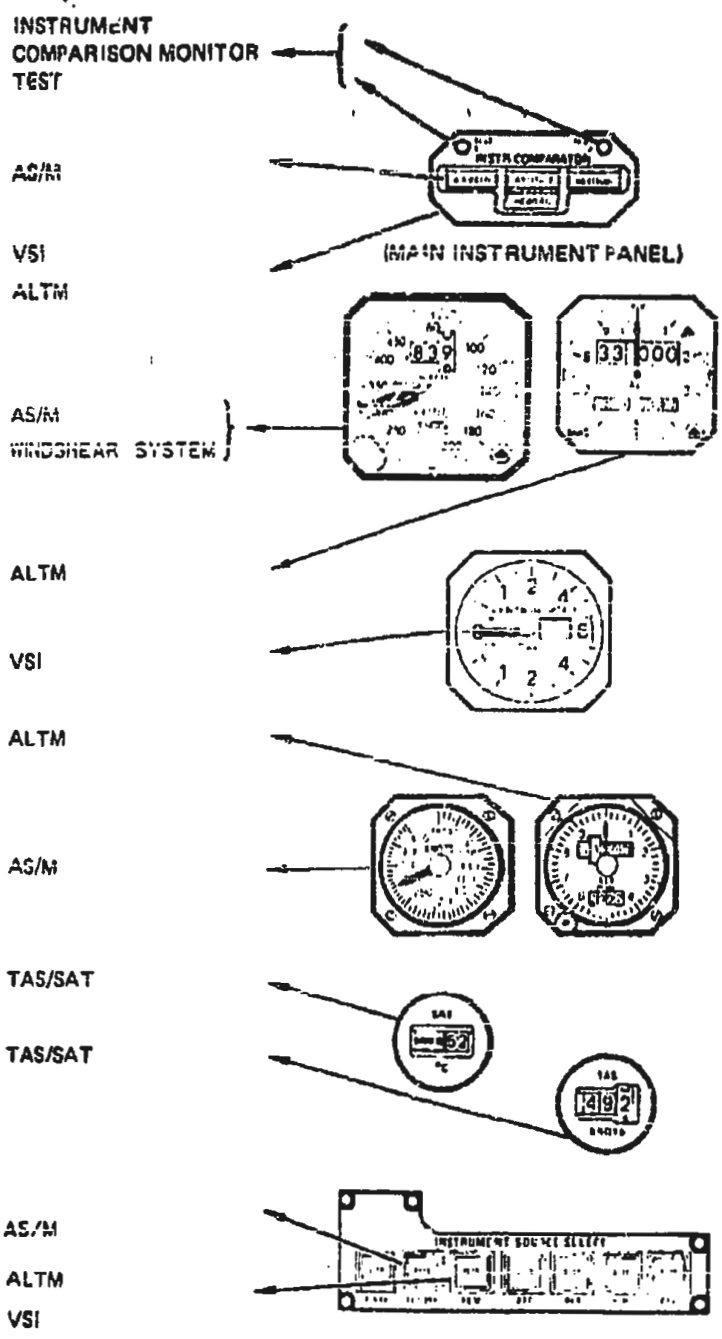
M1 0000-34-7085



NAVIGATION CONTENTS

R EFFECTIVITY: ALL
R
001B

NAVIGATION CONTENTS



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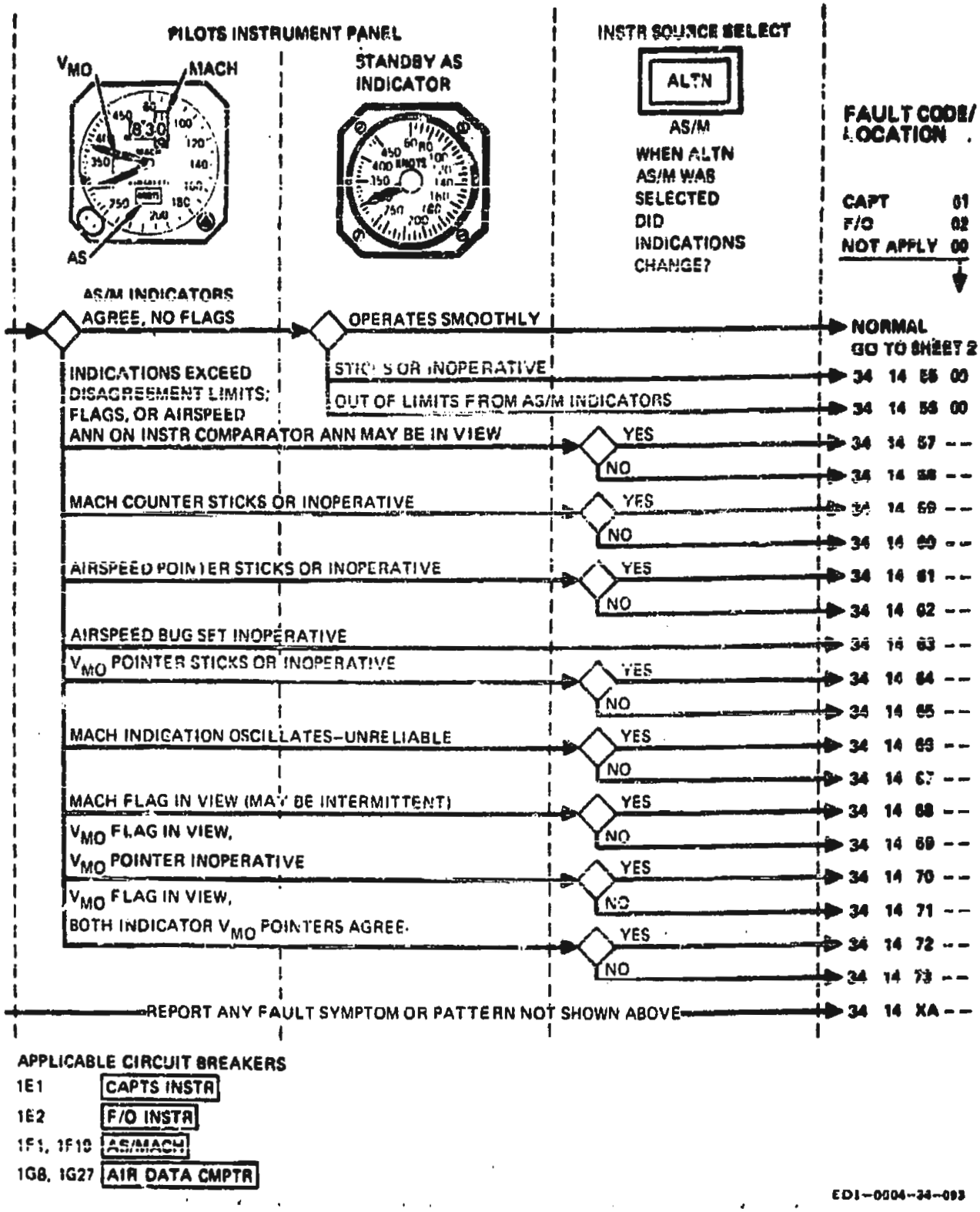
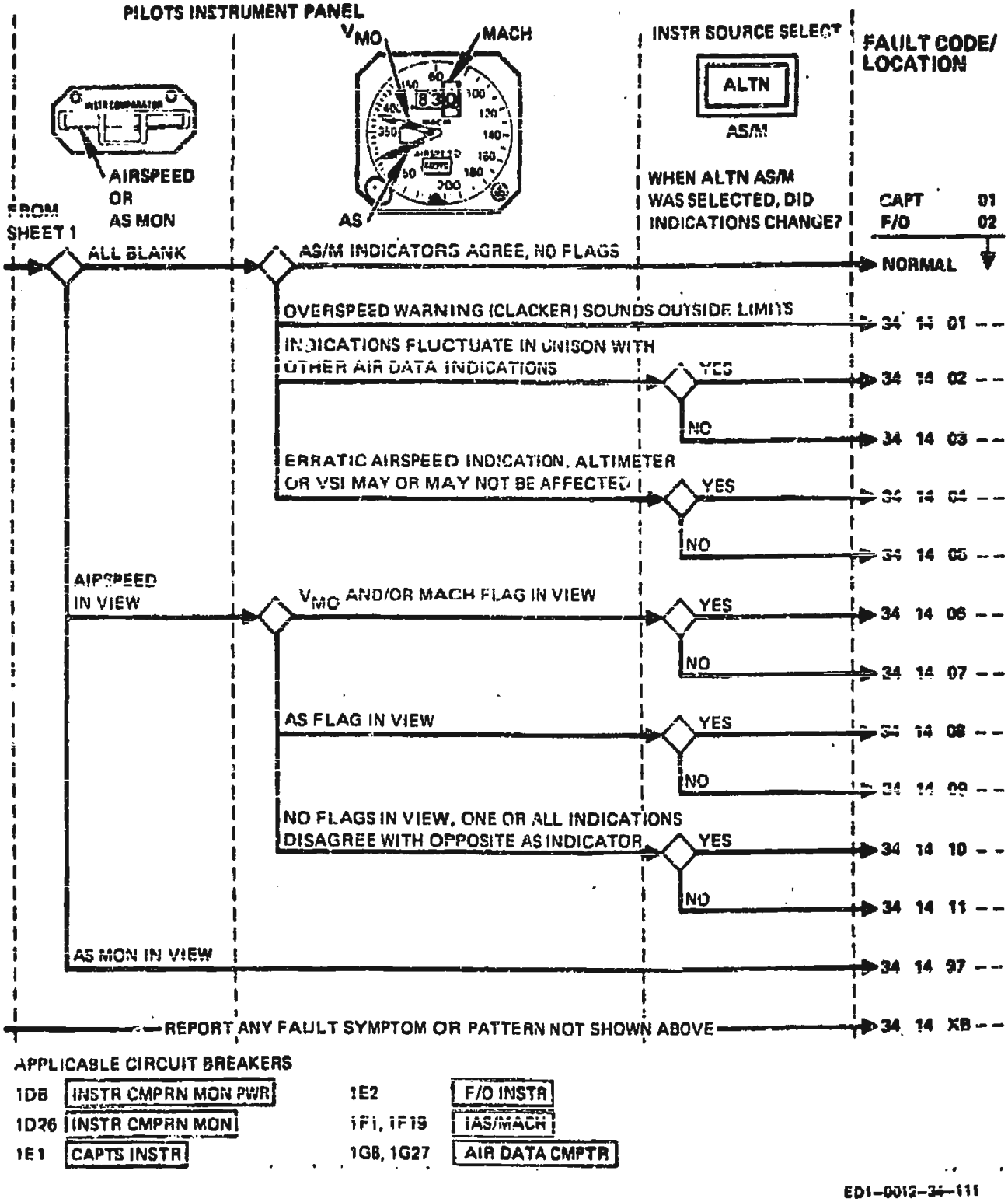
MI-0001-34-7010

NAVIGATION CONTENTS



AIRSPEED/MACH (Sheet 1) - Fault Codes
Figure 1

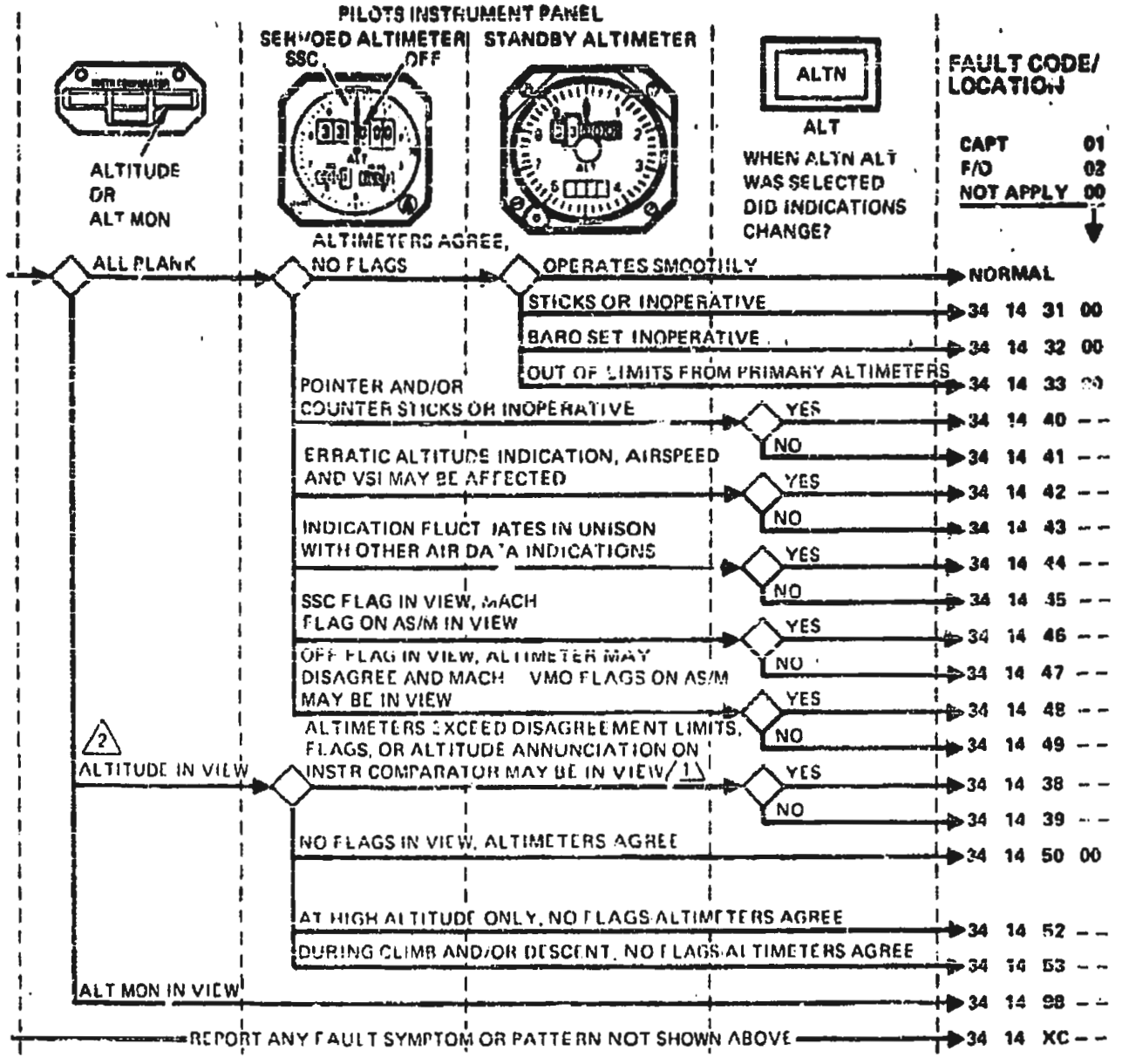


AIRSPEED/MACH (Sheet 2) - Fault Codes
Figure 2

R EFFECTIVITY: ALL

R 050B

34-FAULT CODE DIAGRAM



APPLICABLE CIRCUIT BREAKERS

1D8	INSTR CMPRN MON PWR	1E1	INSTR	1F4, 1F22	ALTM
1D26	INSTR CMPRN MON	1E2	INSTR	1G8, 1G27	AIR DATA CMPTR

NOTE

1\ LOG ENTRY SHOULD BE BASED ON ALTIMETER FLAGS AND/OR ALT COMPARATOR MONITOR TRIPS. OBVIOUS DIFFERENCES BELOW 5,000 FT. SHOULD BE LOGGED REGARDLESS.

2\ VERTICAL SPEEDS OF ± 800 FT/MIN. MAY TRIP COMPARATOR, FURTHER CONFIRMATION REQUIRED.

D1-0017-34-192

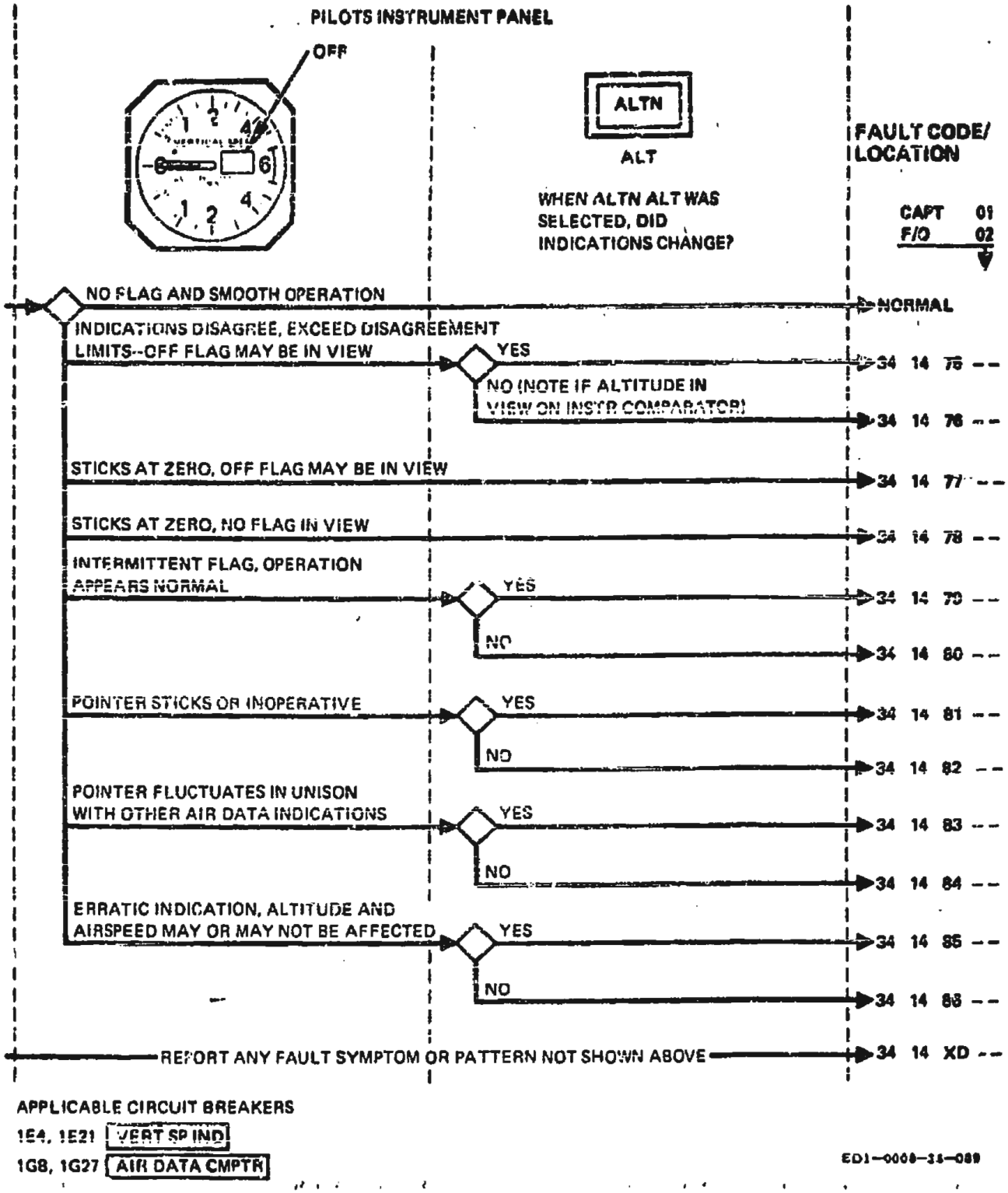
D

ALTIMETER - Fault Codes
Figure 3

R EFFECTIVITY: ALL

050B

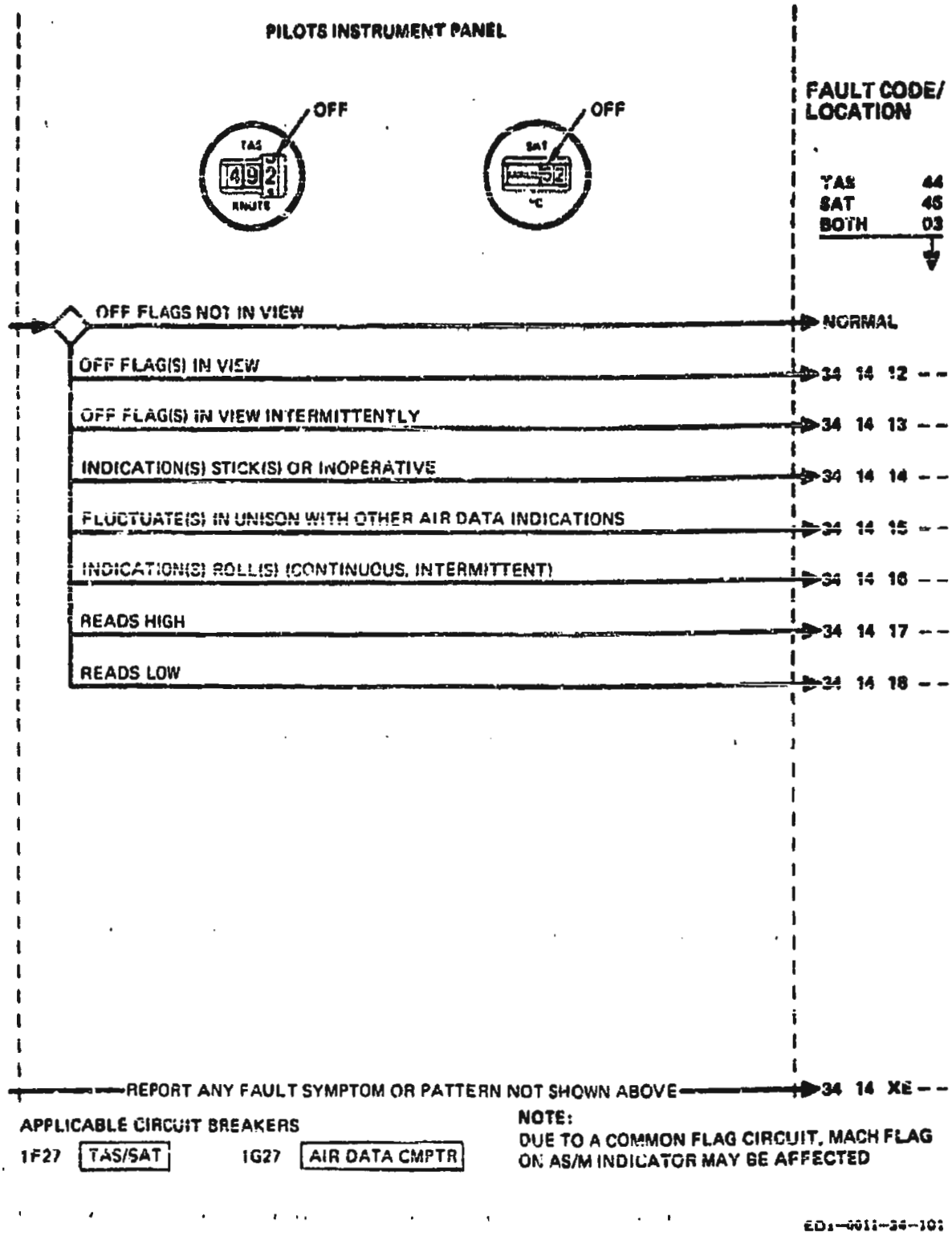
34-FAULT CODE DIAGRAM



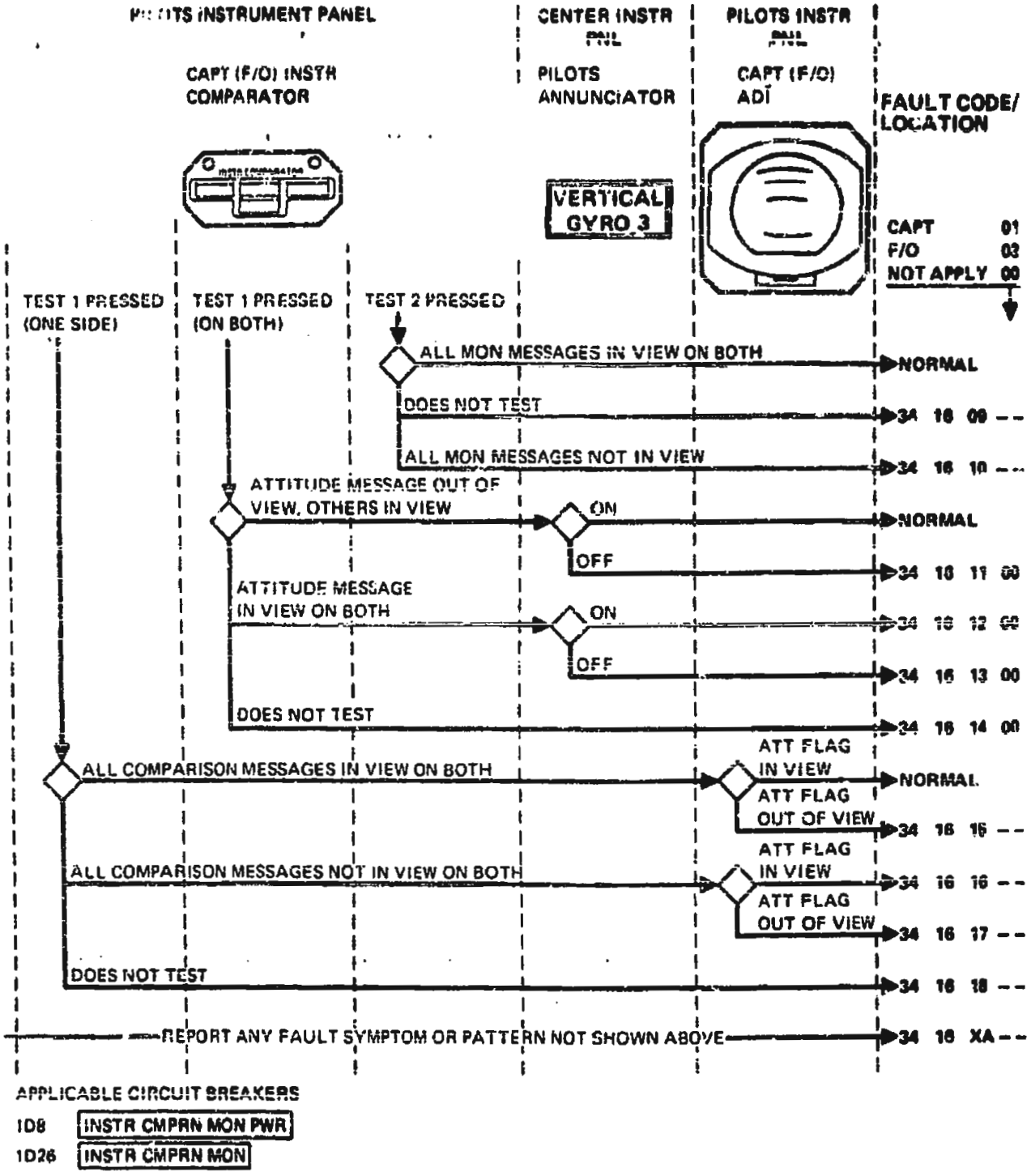
VSI - Fault Codes
Figure 4

R EFFECTIVITY: ALL
R
050B

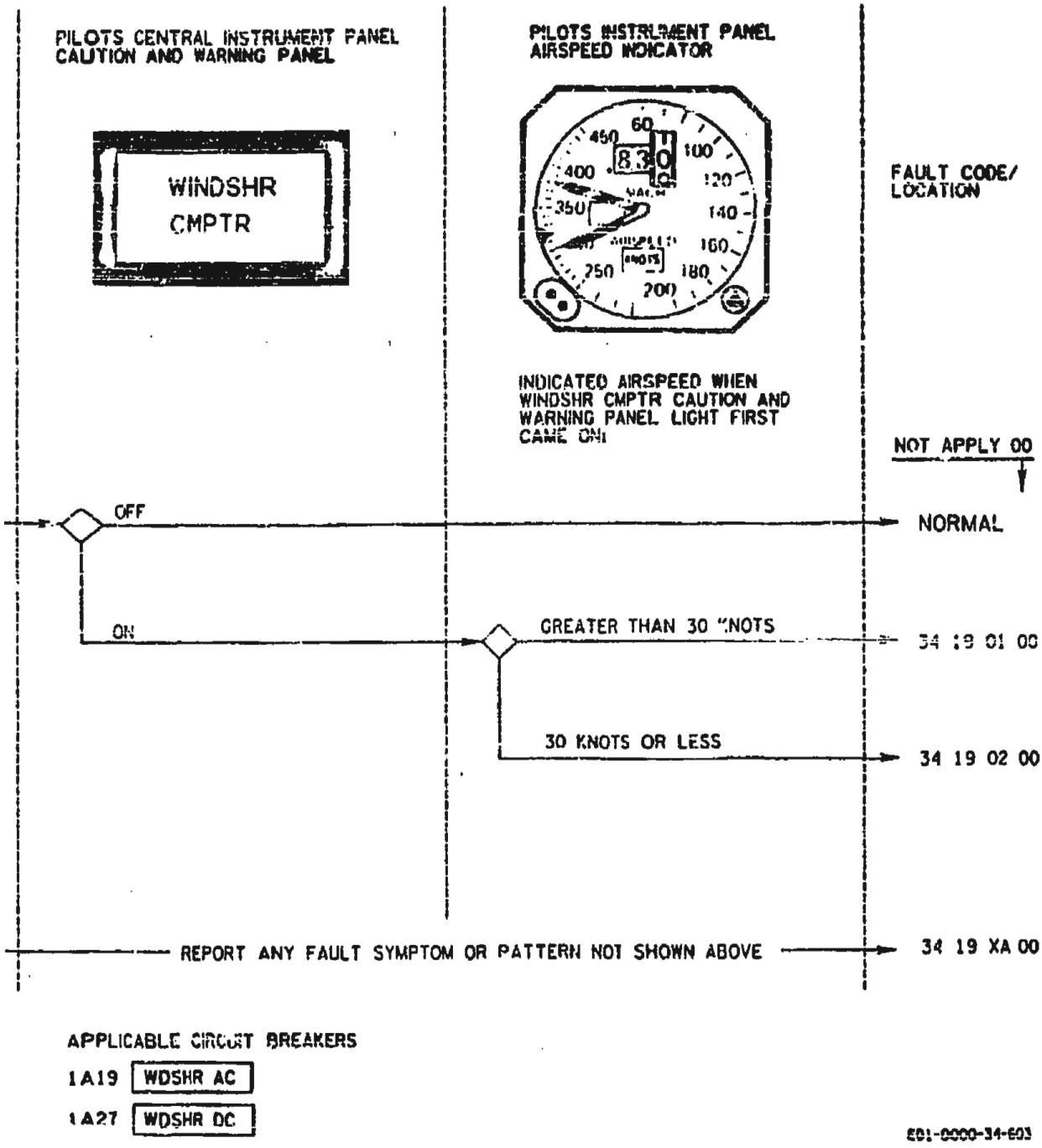
34-FAULT CODE DIAGRAM


PILOTS INSTRUMENT PANEL
OFF
OFF
FAULT CODE/ LOCATION
TAS 44
SAT 45
BOTH 03
OFF FLAGS NOT IN VIEW
NORMAL
OFF FLAG(S) IN VIEW
34 14 12 - -
OFF FLAG(S) IN VIEW INTERMITTENTLY
34 14 13 - -
INDICATION(S) STICK(S) OR INOPERATIVE
34 14 14 - -
FLUCTUATE(S) IN UNISON WITH OTHER AIR DATA INDICATIONS
34 14 15 - -
INDICATION(S) ROLL(S) (CONTINUOUS, INTERMITTENT)
34 14 16 - -
READS HIGH
34 14 17 - -
READS LOW
34 14 18 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
34 14 XE - -
APPLICABLE CIRCUIT BREAKERS
1F27 TAS/SAT
1G27 AIR DATA CMPTR
NOTE:
DUE TO A COMMON FLAG CIRCUIT, MACH FLAG ON AS/M INDICATOR MAY BE AFFECTED
ED1-0011-34-101

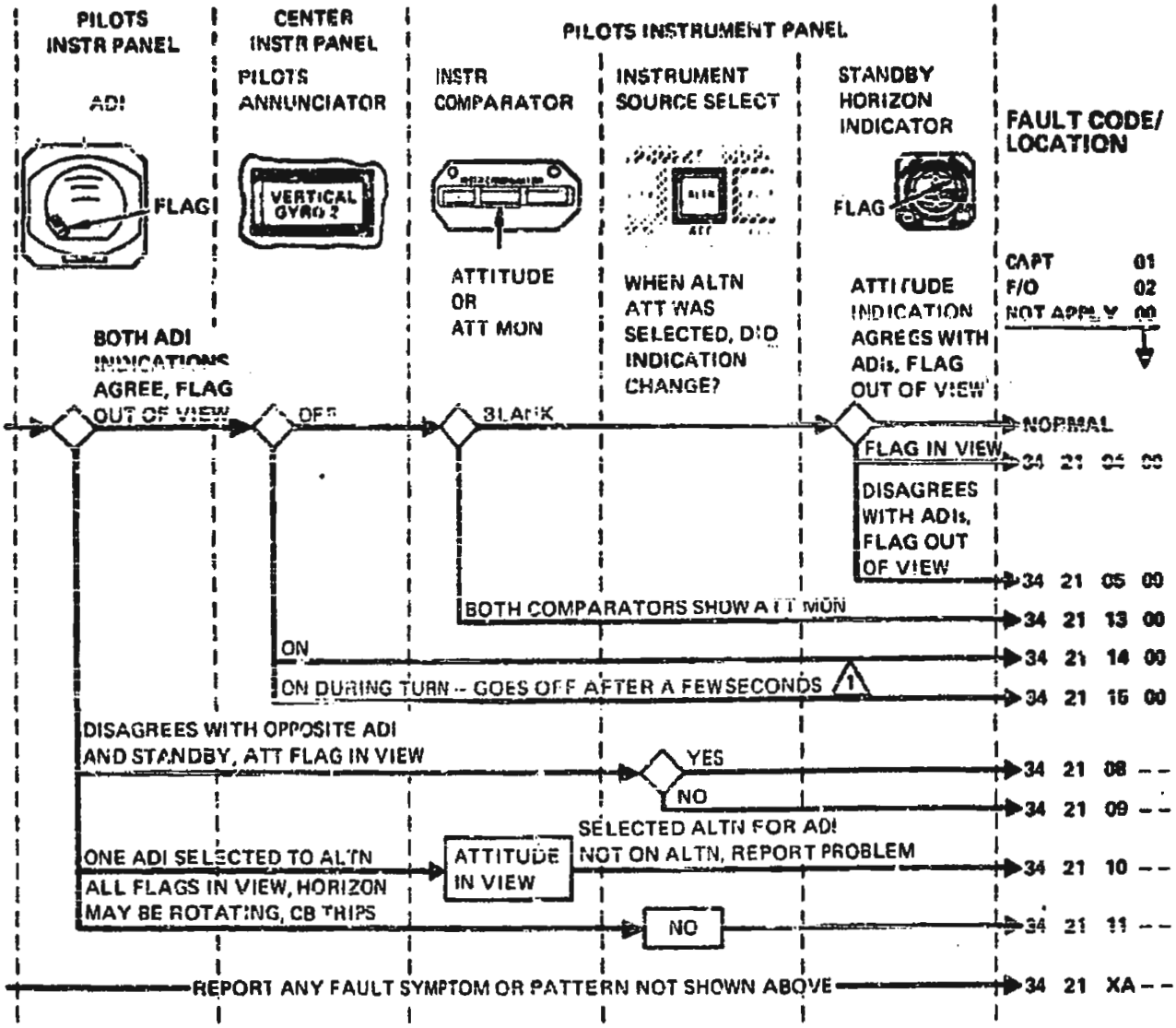
TAS/SAT - Fault Codes
Figure 5



Instrument Comparison Monitor Test - Fault Codes
Figure 6



R Windshear System - Fault Codes
Figure 7


PILOTS INSTR PANEL
ADI
FLAG
CENTER INSTR PANEL
PILOTS ANNUNCIATOR
VERTICAL GYRO 2
PILOTS INSTRUMENT PANEL
INSTR COMPARATOR
ATTITUDE OR ATT MON
INSTRUMENT SOURCE SELECT
WHEN ALTN ATT WAS SELECTED, DID INDICATION CHANGE?
STANDBY HORIZON INDICATOR
FLAG
ATTITUDE INDICATION AGREES WITH ADIs, FLAG OUT OF VIEW
FAULT CODE/ LOCATION
CAPT 01
F/O 02
NOT APPLY 00
BOTH ADI INDICATIONS AGREE, FLAG OUT OF VIEW
OFF
BLANK
NORMAL
FLAG IN VIEW
34 21 04 00
DISAGREES WITH ADIs, FLAG OUT OF VIEW
34 21 05 00
BOTH COMPARATORS SHOW ATT MON
34 21 13 00
ON
34 21 14 00
ON DURING TURN -- GOES OFF AFTER A FEW SECONDS (1)
34 21 15 00
DISAGREES WITH OPPOSITE ADI AND STANDBY, ATT FLAG IN VIEW
YES
34 21 08 - -
NO
34 21 09 - -
SELECTED ALTN FOR ADI NOT ON ALTN, REPORT PROBLEM
ONE ADI SELECTED TO ALTN
ATTITUDE IN VIEW
34 21 10 - -
ALL FLAGS IN VIEW, HORIZON MAY BE ROTATING, CB TRIPS
NO
34 21 11 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
34 21 XA - -

APPLICABLE CIRCUIT BREAKERS

• 1E6	INS PWR	1F2	CAPT ADI	1G6	VS/INS-1
• 1E7	INS HTR	1F6	STBY HRZN	1G24	INS/VERT GYRO
1E24	INS-3/GYRO-3	1F20	F/O ADI	• 1G25	INS HTR

NOTE

(1) AIRCRAFT WITHOUT INS

*AIRCRAFT WITH INS

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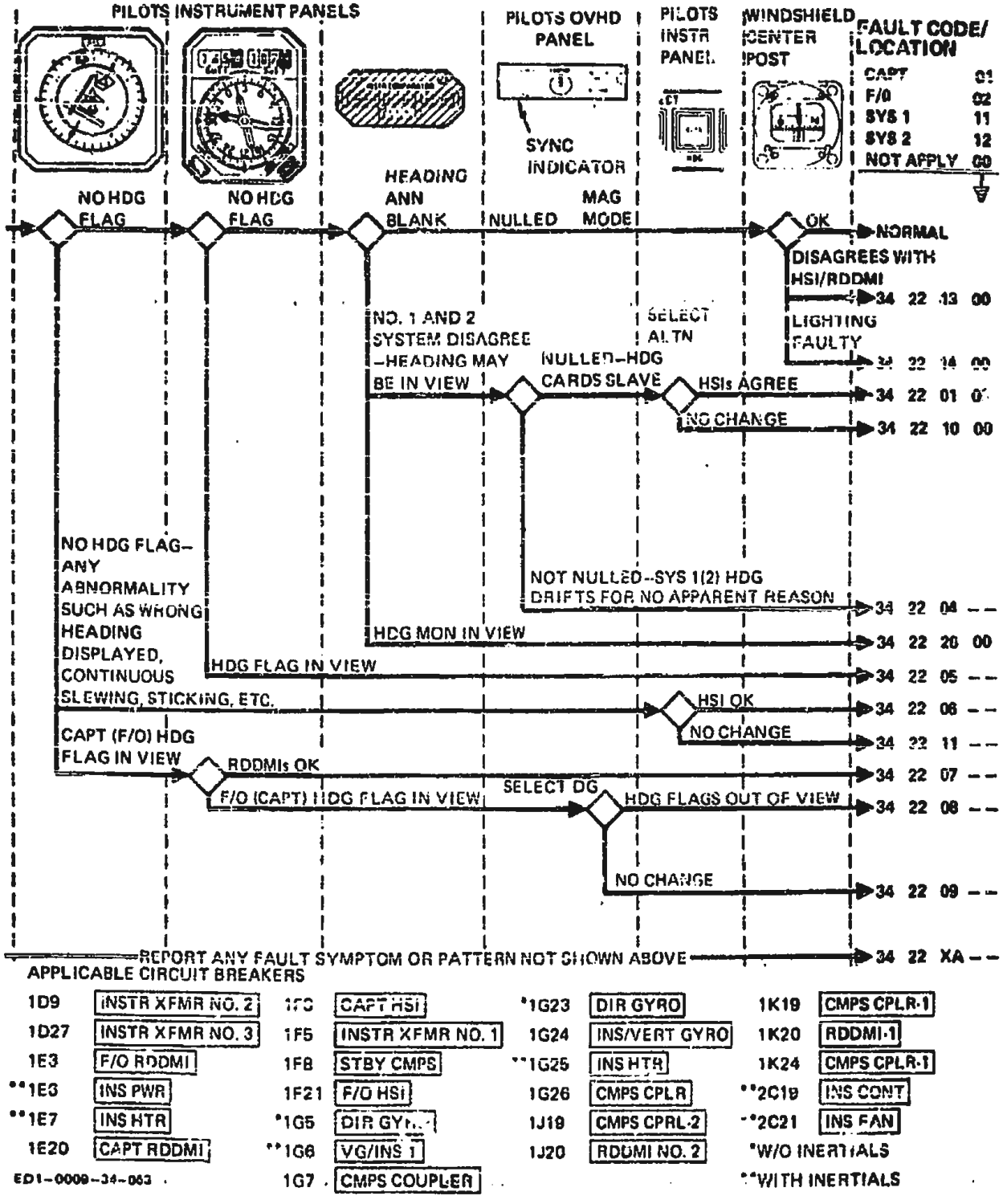
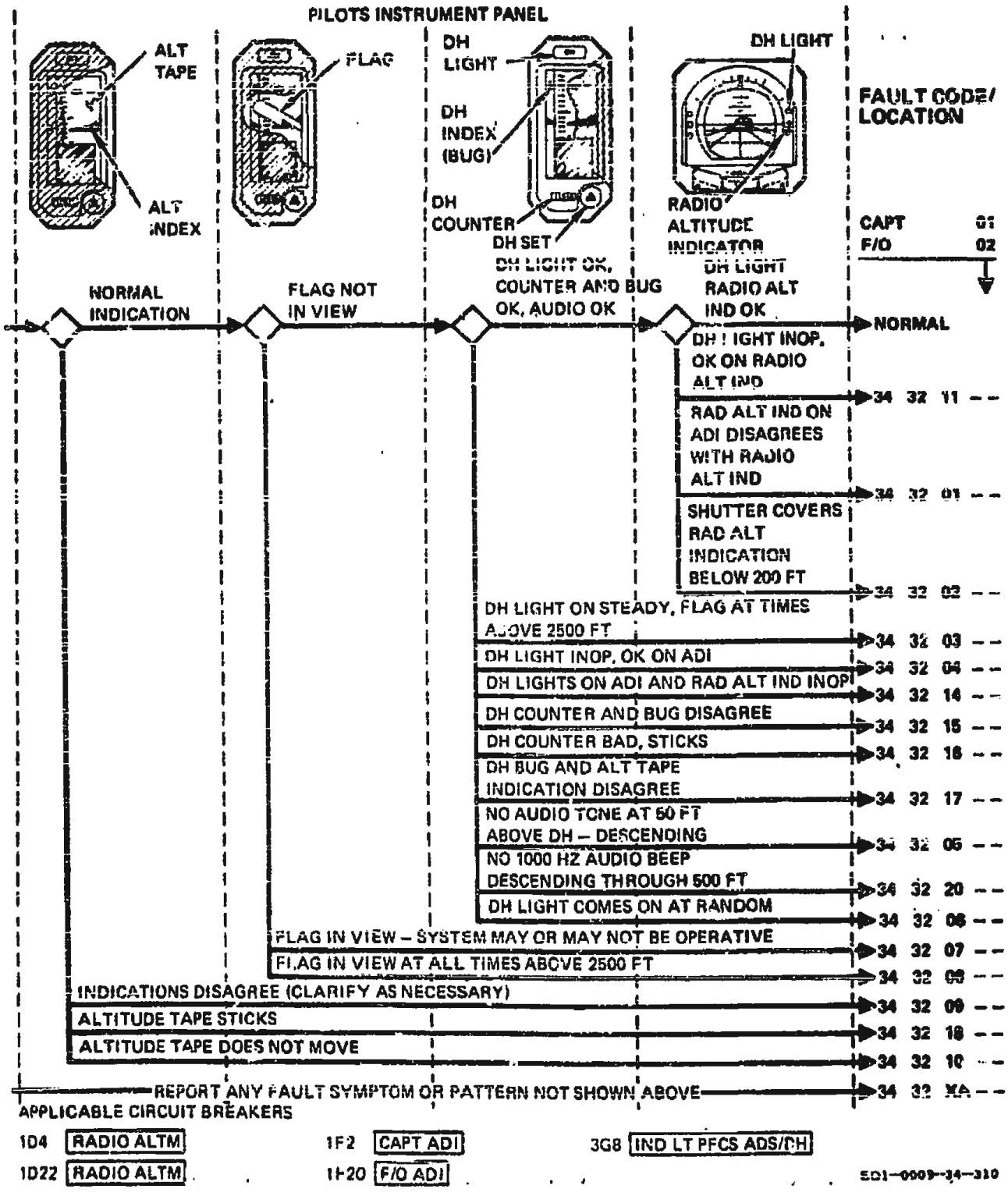
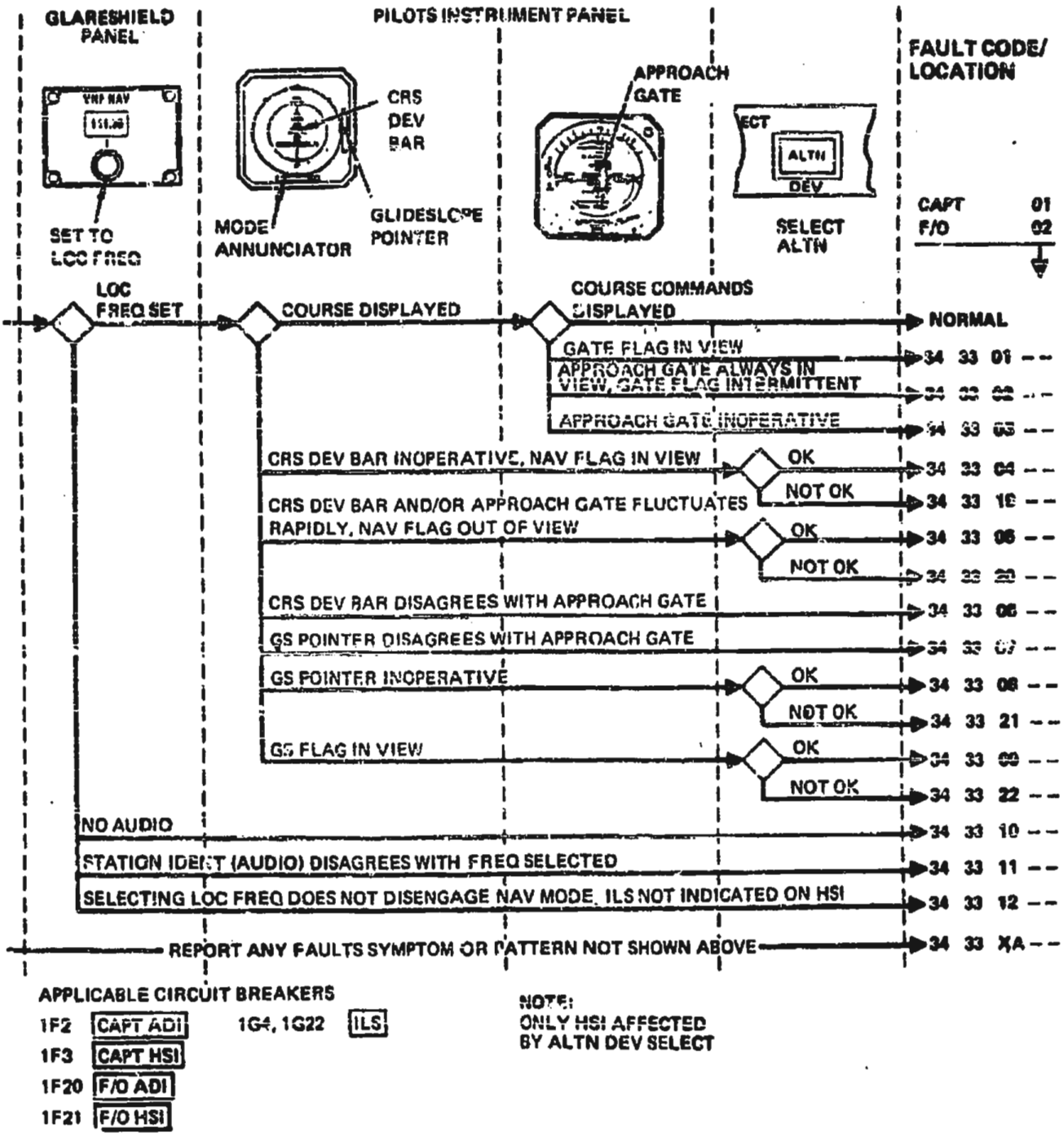
Attitude Reference System - Fault Codes
Figure 8



Heading System - Fault Codes
Figure 9


PILOTS INSTRUMENT PANEL
ALT TAPE
ALT INDEX
FLAG
DH LIGHT
DH INDEX (BUG)
DH COUNTER
DH SET
DH LIGHT
RADIO ALTITUDE INDICATOR
FAULT CODE/ LOCATION
CAPT 01
F/O 02
NORMAL INDICATION
FLAG NOT IN VIEW
DH LIGHT OK, COUNTER AND BUG OK, AUDIO OK
DH LIGHT RADIO ALT IND OK
NORMAL
DH LIGHT INOP, OK ON RADIO ALT IND
34 32 11 - -
RAD ALT IND ON ADI DISAGREES WITH RADIO ALT IND
34 32 01 - -
SHUTTER COVERS RAD ALT INDICATION BELOW 200 FT
34 32 02 - -
DH LIGHT ON STEADY, FLAG AT TIMES ABOVE 2500 FT
34 32 03 - -
DH LIGHT INOP, OK ON ADI
34 32 04 - -
DH LIGHTS ON ADI AND RAD ALT IND INOP
34 32 14 - -
DH COUNTER AND BUG DISAGREE
34 32 15 - -
DH COUNTER BAD, STICKS
34 32 16 - -
DH BUG AND ALT TAPE INDICATION DISAGREE
34 32 17 - -
NO AUDIO TONE AT 50 FT ABOVE DH – DESCENDING
34 32 05 - -
NO 1000 HZ AUDIO BEEP DESCENDING THROUGH 500 FT
34 32 20 - -
DH LIGHT COMES ON AT RANDOM
34 32 06 - -
FLAG IN VIEW – SYSTEM MAY OR MAY NOT BE OPERATIVE
34 32 07 - -
FLAG IN VIEW AT ALL TIMES ABOVE 2500 FT
34 32 08 - -
INDICATIONS DISAGREE (CLARIFY AS NECESSARY)
34 32 09 - -
ALTITUDE TAPE STICKS
34 32 18 - -
ALTITUDE TAPE DOES NOT MOVE
34 32 10 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
34 32 XA - -
APPLICABLE CIRCUIT BREAKERS
1D4 RADIO ALTM
1D22 RADIO ALTM
1F2 CAPT ADI
1F20 F/O ADI
3G8 IND LT PFCS ADS/DH
SD1-0009-34-310

Radio Altimeter - Fault Codes
Figure 10

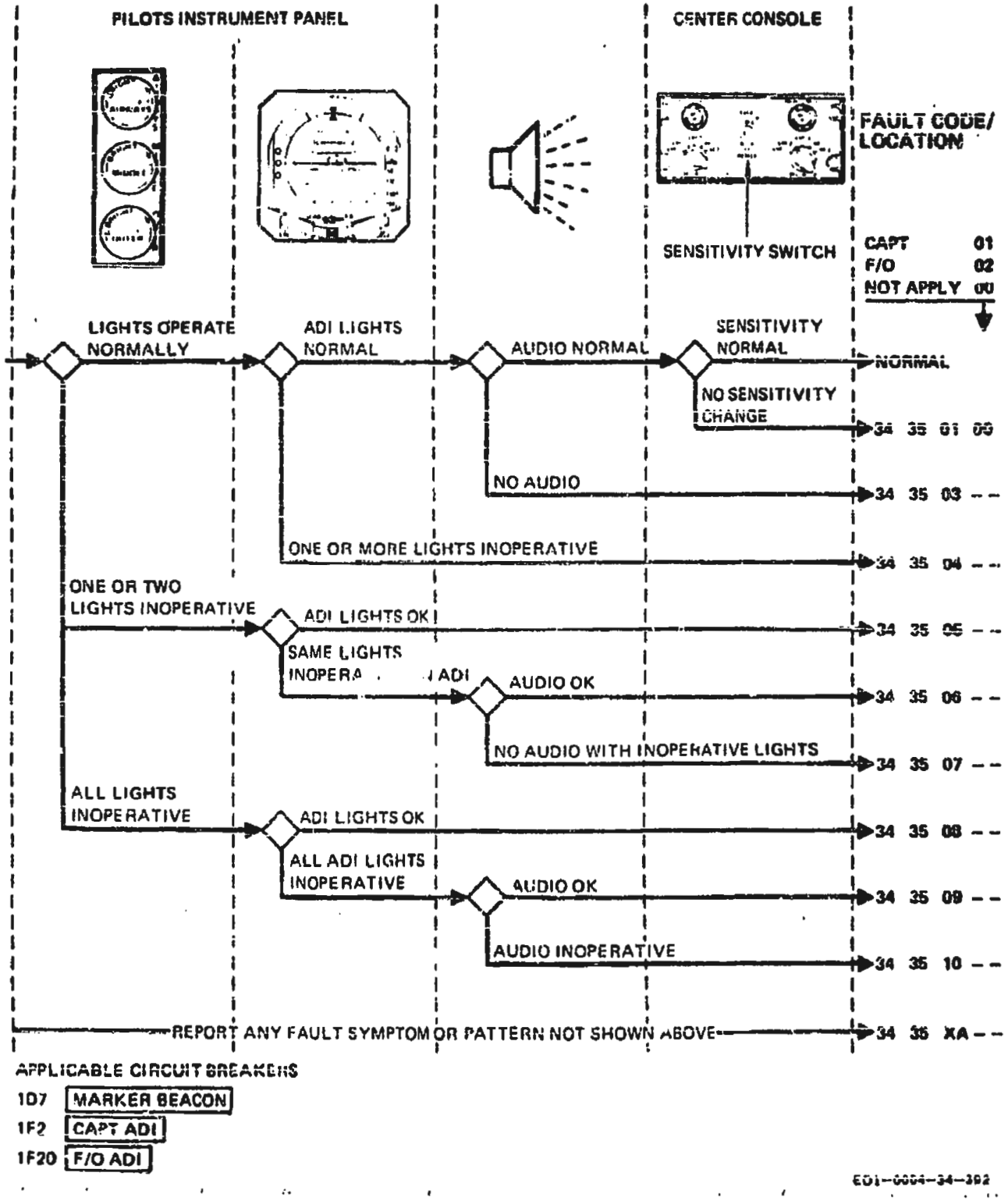

GLARESHIELD PANEL
PILOTS INSTRUMENT PANEL
FAULT CODE/ LOCATION
VHF NAV
SET TO LOC FREQ
CRS DEV BAR
MODE ANNUNCIATOR
GLIDESLOPE POINTER
APPROACH GATE
ALTN
DEV
SELECT ALTN
CAPT 01
F/O 02
LOC FREQ SET
COURSE DISPLAYED
COURSE COMMANDS DISPLAYED
NORMAL
GATE FLAG IN VIEW
34 33 01 - -
APPROACH GATE ALWAYS IN VIEW, GATE FLAG INTERMITTENT
APPROACH GATE INOPERATIVE
CRS DEV BAR INOPERATIVE, NAV FLAG IN VIEW
OK
NOT OK
34 33 04 - -
CRS DEV BAR AND/OR APPROACH GATE FLUCTUATES RAPIDLY, NAV FLAG OUT OF VIEW
34 33 05 - -
CRS DEV BAR DISAGREES WITH APPROACH GATE
34 33 06 - -
GS POINTER DISAGREES WITH APPROACH GATE
GS POINTER INOPERATIVE
34 33 08 - -
34 33 21 - -
GS FLAG IN VIEW
34 33 22 - -
NO AUDIO
34 33 10 - -
STATION IDENT (AUDIO) DISAGREES WITH FREQ SELECTED
34 33 11 - -
SELECTING LOC FREQ DOES NOT DISENGAGE NAV MODE, ILS NOT INDICATED ON HSI
34 33 12 - -
REPORT ANY FAULTS SYMPTOM OR PATTERN NOT SHOWN ABOVE
34 33 XA - -
APPLICABLE CIRCUIT BREAKERS
1F2 CAPT ADI
1F3 CAPT HSI
1F20 F/O ADI
1F21 F/O HSI
1G4, 1G22 ILS
NOTE:
ONLY HSI AFFECTED BY ALTN DEV SELECT

EQ1-0007-34-067

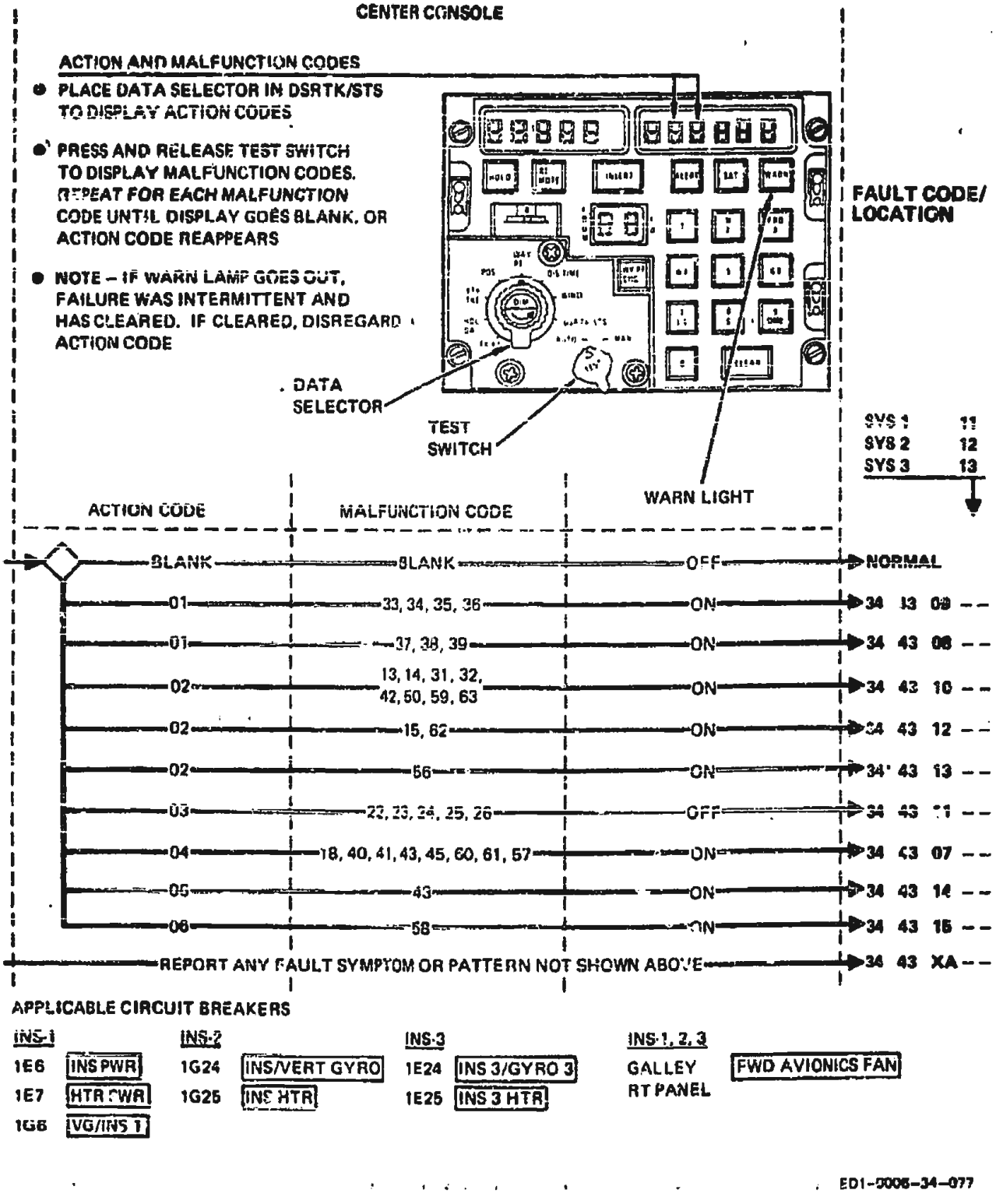
ILS - Fault Codes
Figure 11

R EFFECTIVITY: ALL
R
050B

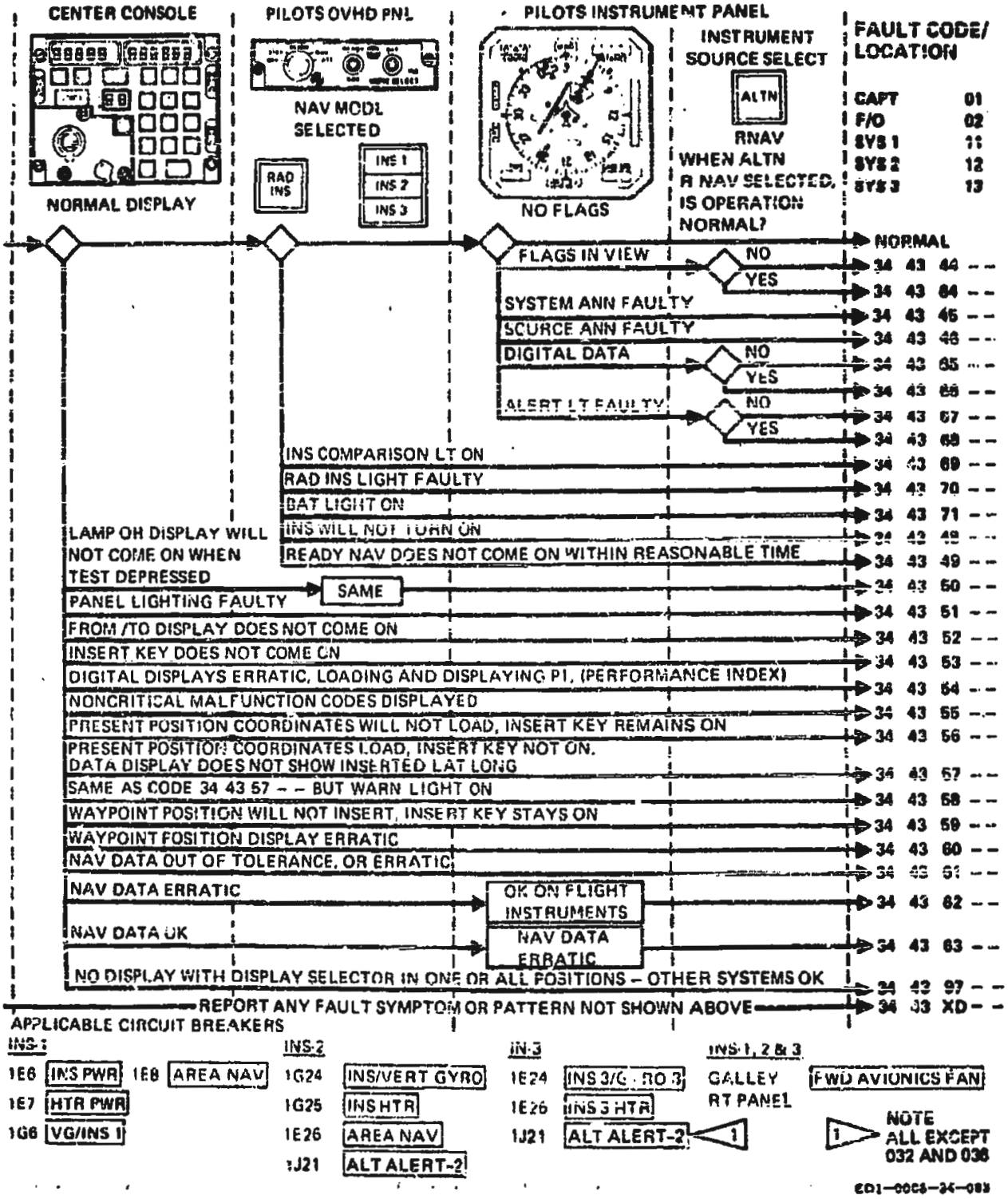
34-FAULT CODE DIAGRAM



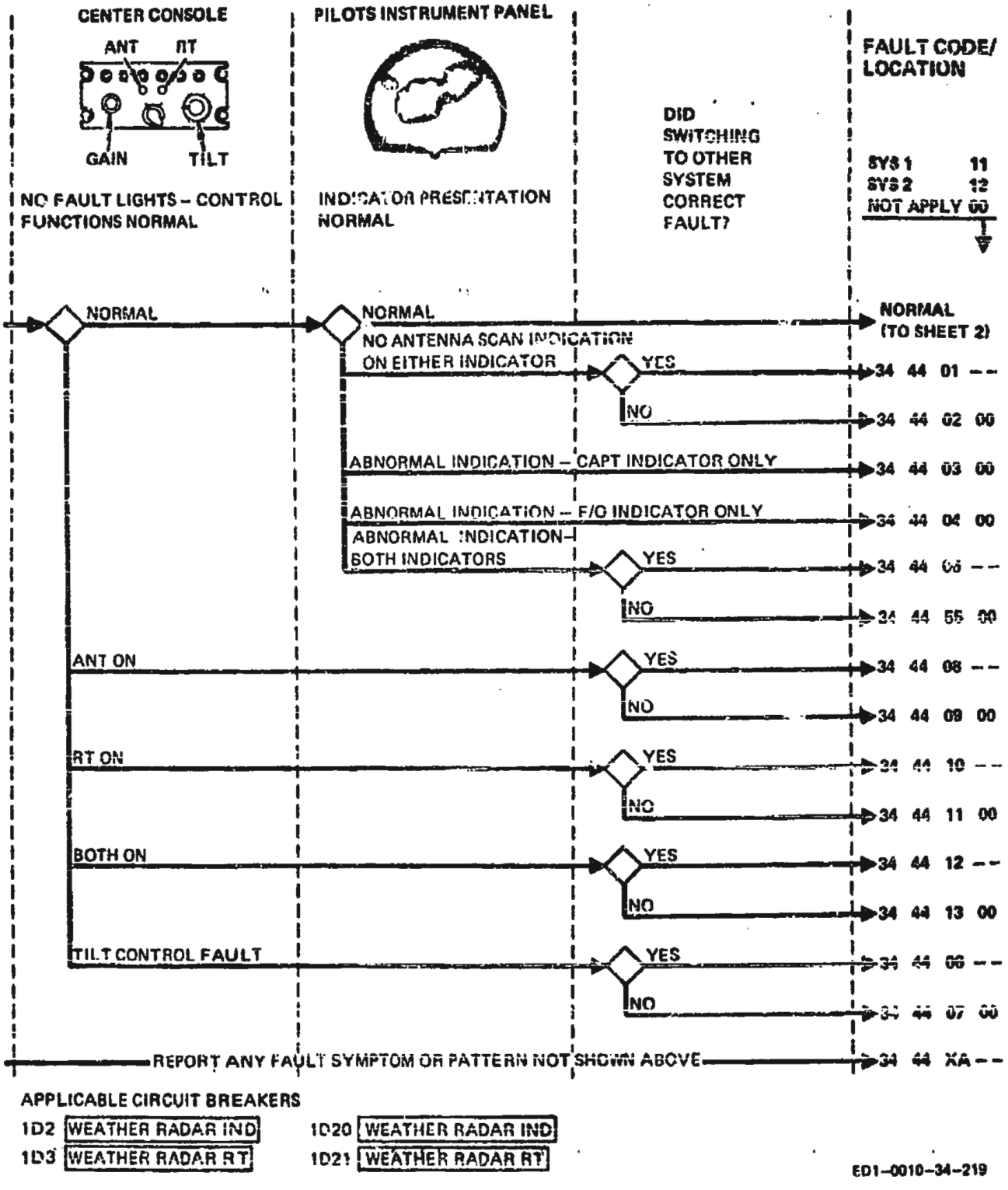
Marker Beacon - Fault Codes
Figure 12


CENTER CONSOLE
ACTION AND MALFUNCTION CODES
● PLACE DATA SELECTOR IN DSRTK/STS TO DISPLAY ACTION CODES
● PRESS AND RELEASE TEST SWITCH TO DISPLAY MALFUNCTION CODES. REPEAT FOR EACH MALFUNCTION CODE UNTIL DISPLAY GOES BLANK, OR ACTION CODE REAPPEARS
● NOTE – IF WARN LAMP GOES OUT, FAILURE WAS INTERMITTENT AND HAS CLEARED. IF CLEARED, DISREGARD ACTION CODE
DATA SELECTOR
TEST SWITCH
FAULT CODE/ LOCATION
SYS 1 11
SYS 2 12
SYS 3 13
WARN LIGHT
ACTION CODE
MALFUNCTION CODE
BLANK BLANK OFF NORMAL
01 33, 34, 35, 36 ON 34 13 09 - -
01 37, 38, 39 ON 34 43 08 - -
02 13, 14, 31, 32, 42, 50, 59, 63 ON 34 43 10 - -
02 15, 62 ON 34 43 12 - -
02 56 ON 34 43 13 - -
03 22, 23, 24, 25, 26 OFF 34 43 11 - -
04 18, 40, 41, 43, 45, 60, 61, 57 ON 34 43 07 - -
05 43 ON 34 43 14 - -
06 58 ON 34 43 15 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE 34 43 XA - -
APPLICABLE CIRCUIT BREAKERS
INS-1
1E6 INS PWR
1E7 HTR PWR
1G6 VG/INS 1
INS-2
1G24 INS/VERT GYRO
1G25 INS HTR
INS-3
1E24 INS 3/GYRO 3
1E25 INS 3 HTR
INS-1, 2, 3
GALLEY
RT PANEL
FWD AVIONICS FAN
ED1-0006-34-077

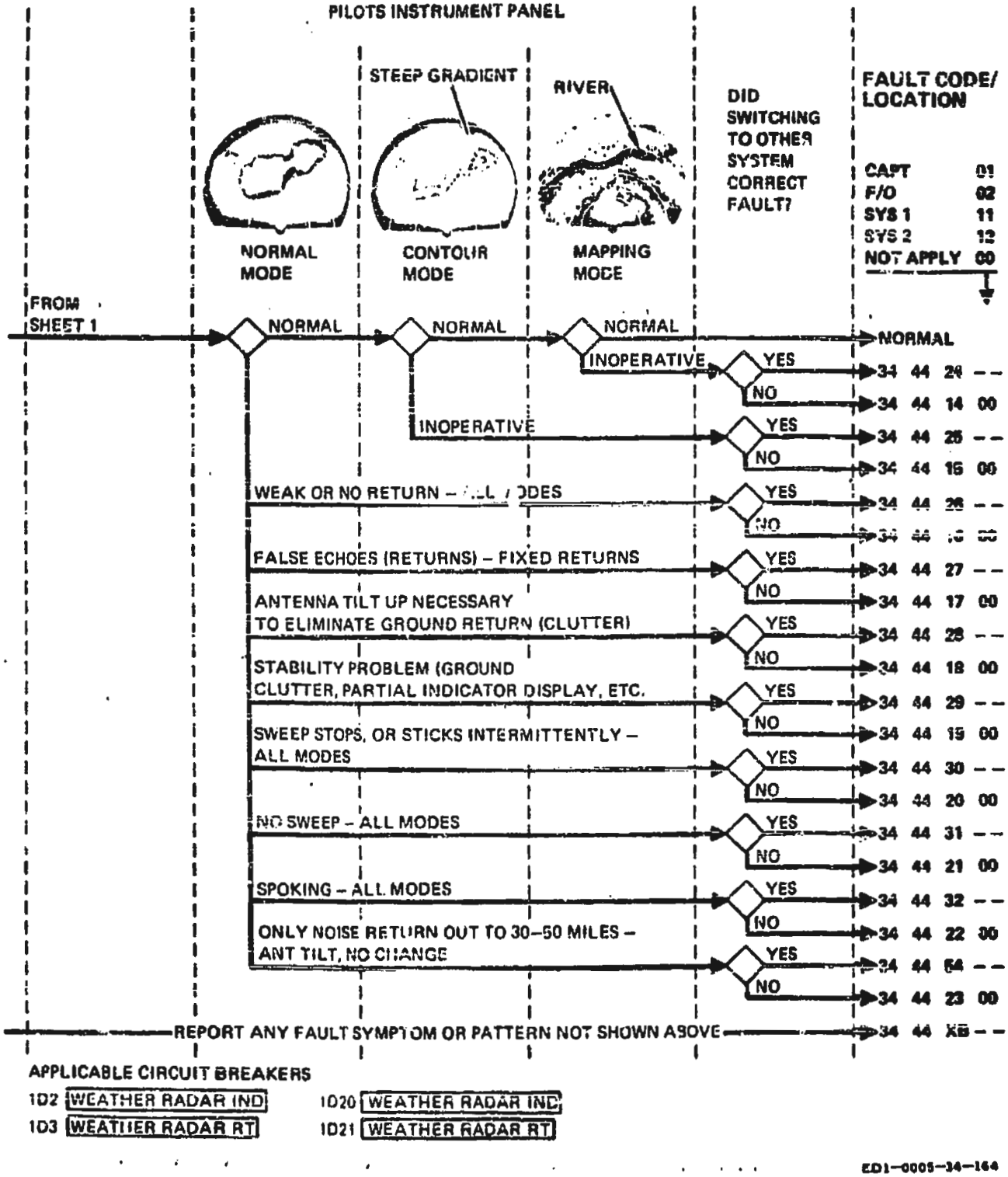
INS - (Action/Malfunction Codes) - Fault Codes
Figure 13


CENTER CONSOLE
PILOTS OVHD PNL
PILOTS INSTRUMENT PANEL
INSTRUMENT SOURCE SELECT
ALTN
RNAV
FAULT CODE/ LOCATION
CAPT 01
F/O 02
SYS 1 11
SYS 2 12
SYS 3 13
NAV MODE SELECTED
RAD INS
INS 1
INS 2
INS 3
NORMAL DISPLAY
NO FLAGS
WHEN ALTN R NAV SELECTED, IS OPERATION NORMAL?
NORMAL
FLAGS IN VIEW
NO
YES
SYSTEM ANN FAULTY
SOURCE ANN FAULTY
DIGITAL DATA
ALERT LT FAULTY
INS COMPARISON LT ON
RAD INS LIGHT FAULTY
BAT LIGHT ON
INS WILL NOT TURN ON
READY NAV DOES NOT COME ON WITHIN REASONABLE TIME
LAMP OR DISPLAY WILL NOT COME ON WHEN TEST DEPRESSED
SAME
PANEL LIGHTING FAULTY
FROM /TO DISPLAY DOES NOT COME ON
INSERT KEY DOES NOT COME ON
DIGITAL DISPLAYS ERRATIC, LOADING AND DISPLAYING PI, (PERFORMANCE INDEX)
NONCRITICAL MALFUNCTION CODES DISPLAYED
PRESENT POSITION COORDINATES WILL NOT LOAD, INSERT KEY REMAINS ON
PRESENT POSITION COORDINATES LOAD, INSERT KEY NOT ON. DATA DISPLAY DOES NOT SHOW INSERTED LAT LONG
SAME AS CODE 34 43 57 - - BUT WARN LIGHT ON
WAYPOINT POSITION WILL NOT INSERT, INSERT KEY STAYS ON
WAYPOINT POSITION DISPLAY ERRATIC
NAV DATA OUT OF TOLERANCE, OR ERRATIC
NAV DATA ERRATIC
OK ON FLIGHT INSTRUMENTS
NAV DATA OK
NAV DATA ERRATIC
NO DISPLAY WITH DISPLAY SELECTOR IN ONE OR ALL POSITIONS - OTHER SYSTEMS OK
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
APPLICABLE CIRCUIT BREAKERS
INS 1:
1E6 INS PWR
1E7 HTR PWR
1G6 VG/INS 1
1E8 AREA NAV
INS 2
1G24 INS/VERT GYRO
1G25 INS HTR
1E26 AREA NAV
1J21 ALT ALERT-2
INS 3
1E24 INS 3/G RO 3
1E26 INS 3 HTR
1J21 ALT ALERT-2
INS 1, 2 & 3
GALLEY RT PANEL
FWD AVIONICS FAN
1
NOTE ALL EXCEPT 032 AND 038

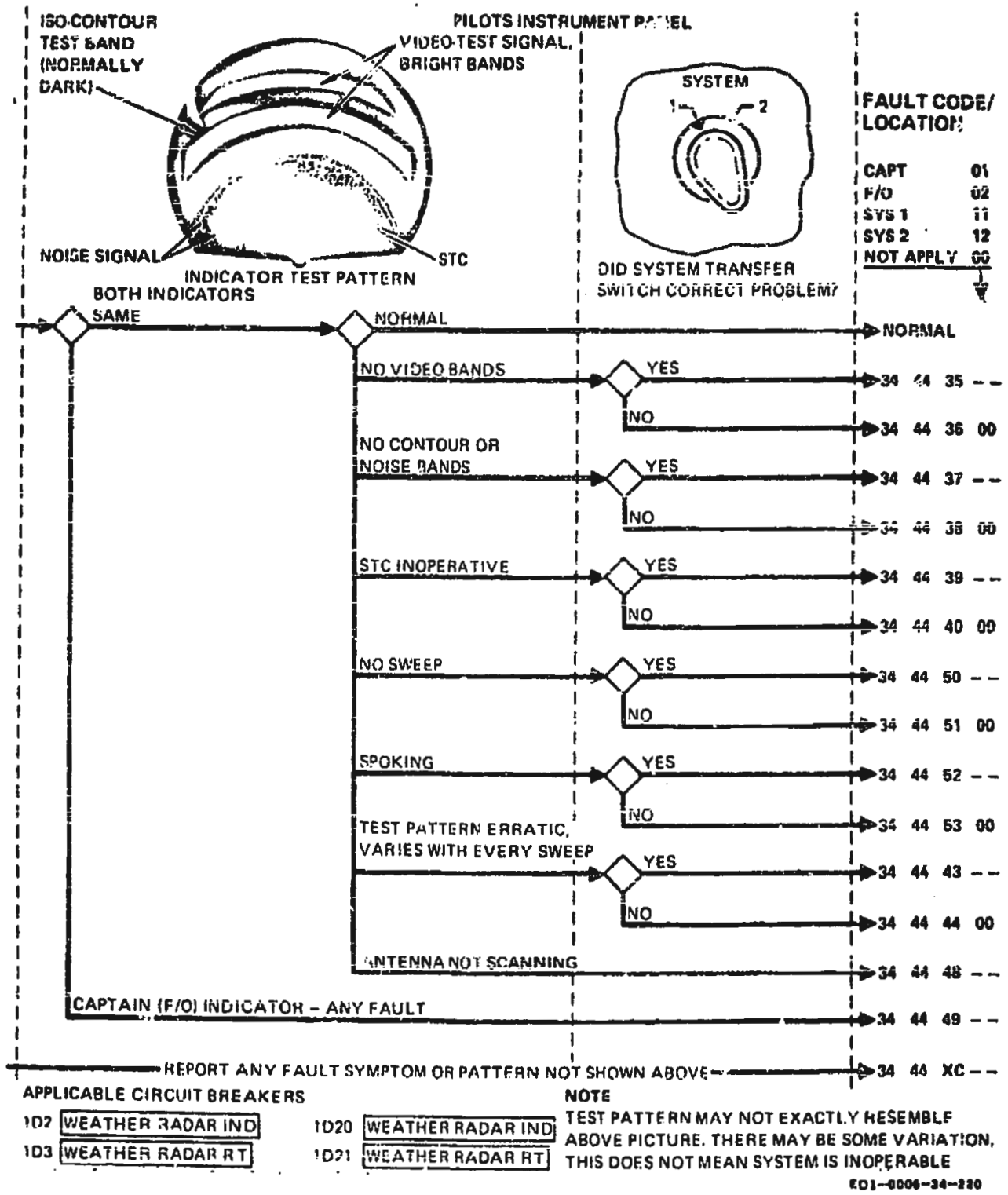
INS - (Non Action/Malfunction Code Faults) - Fault Codes
Figure 14



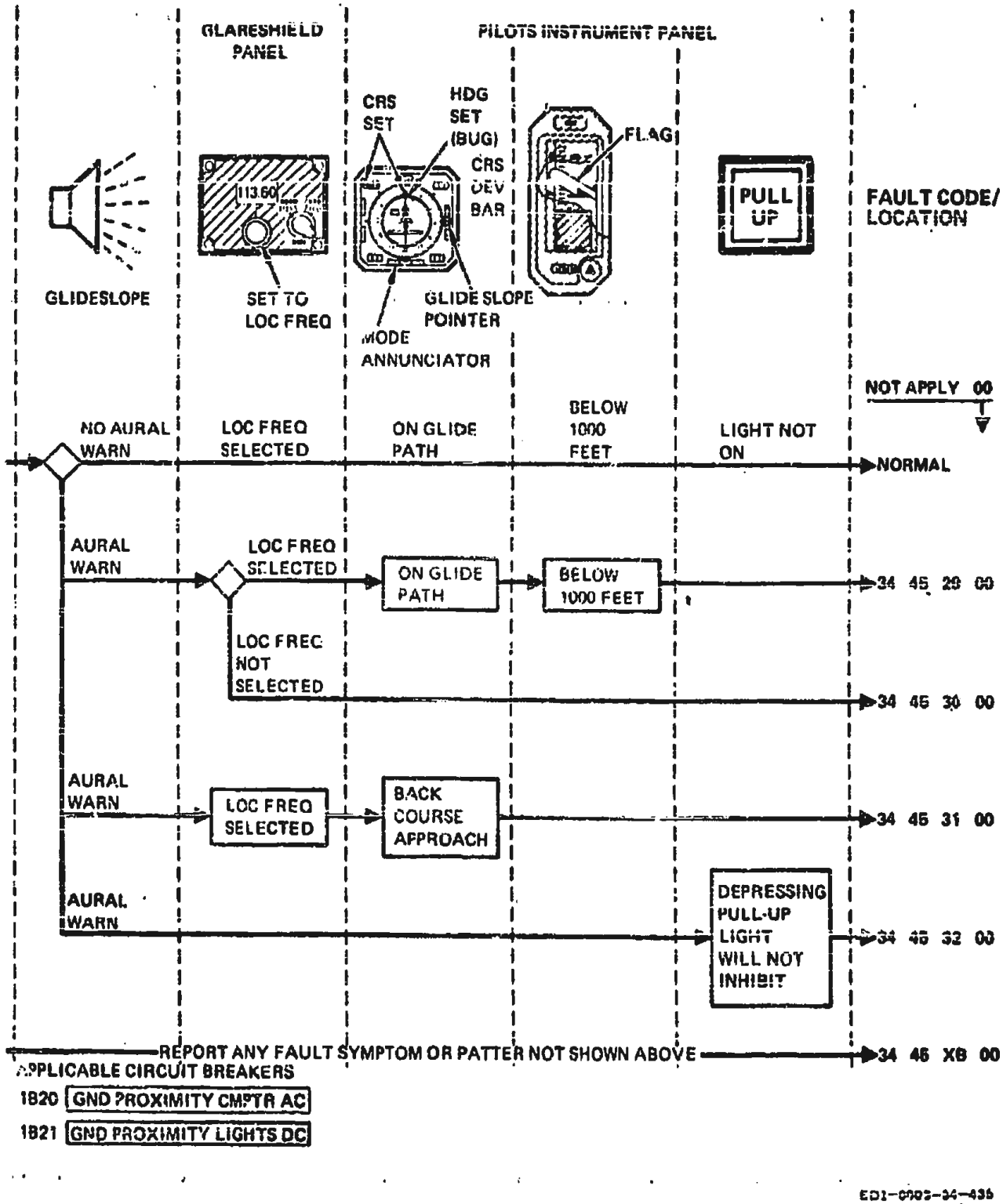
Weather Radar (Sheet 1) - Fault Codes
Figure 15



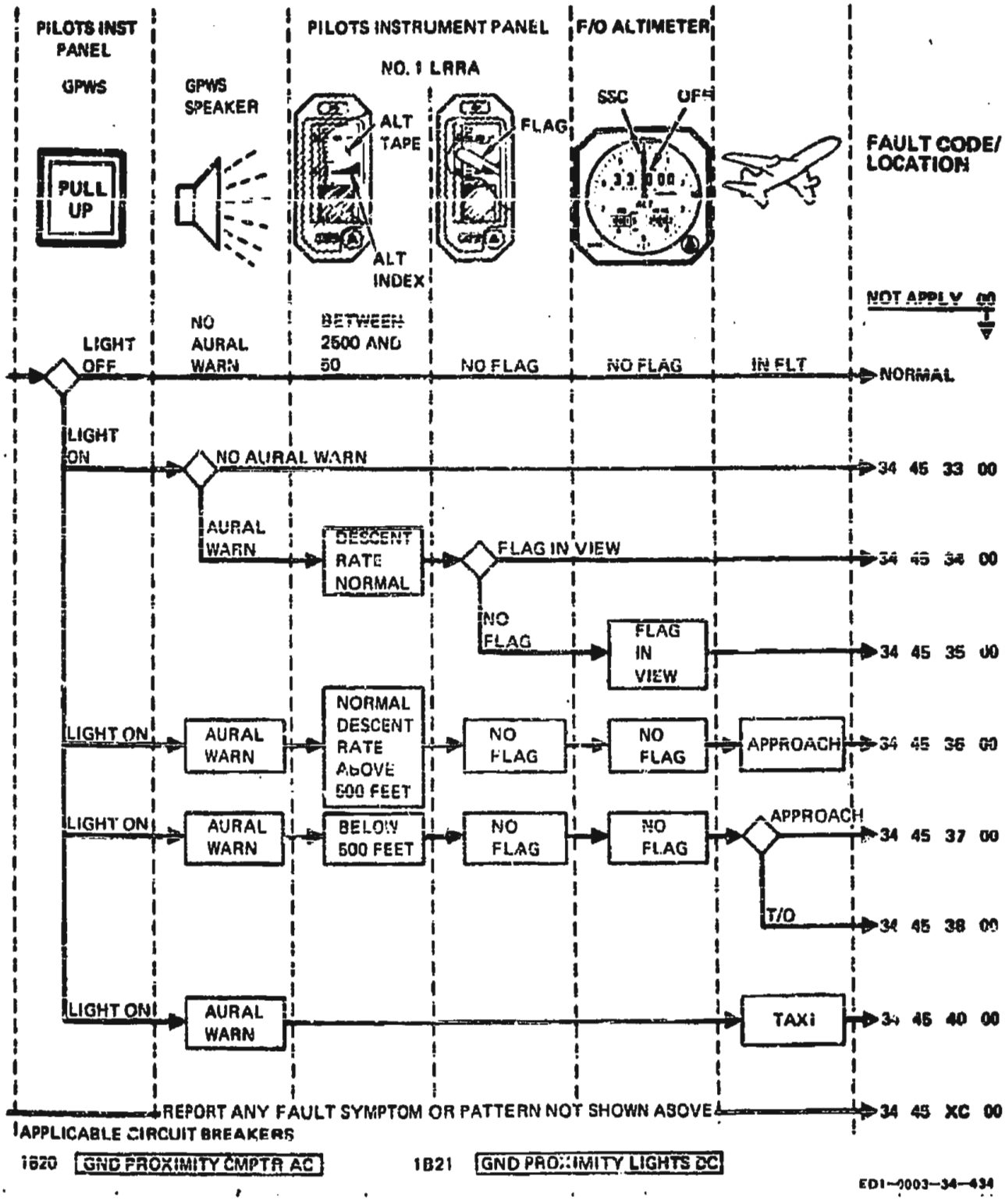
Weather Radar (Sheet 2) - Fault Codes
Figure 16



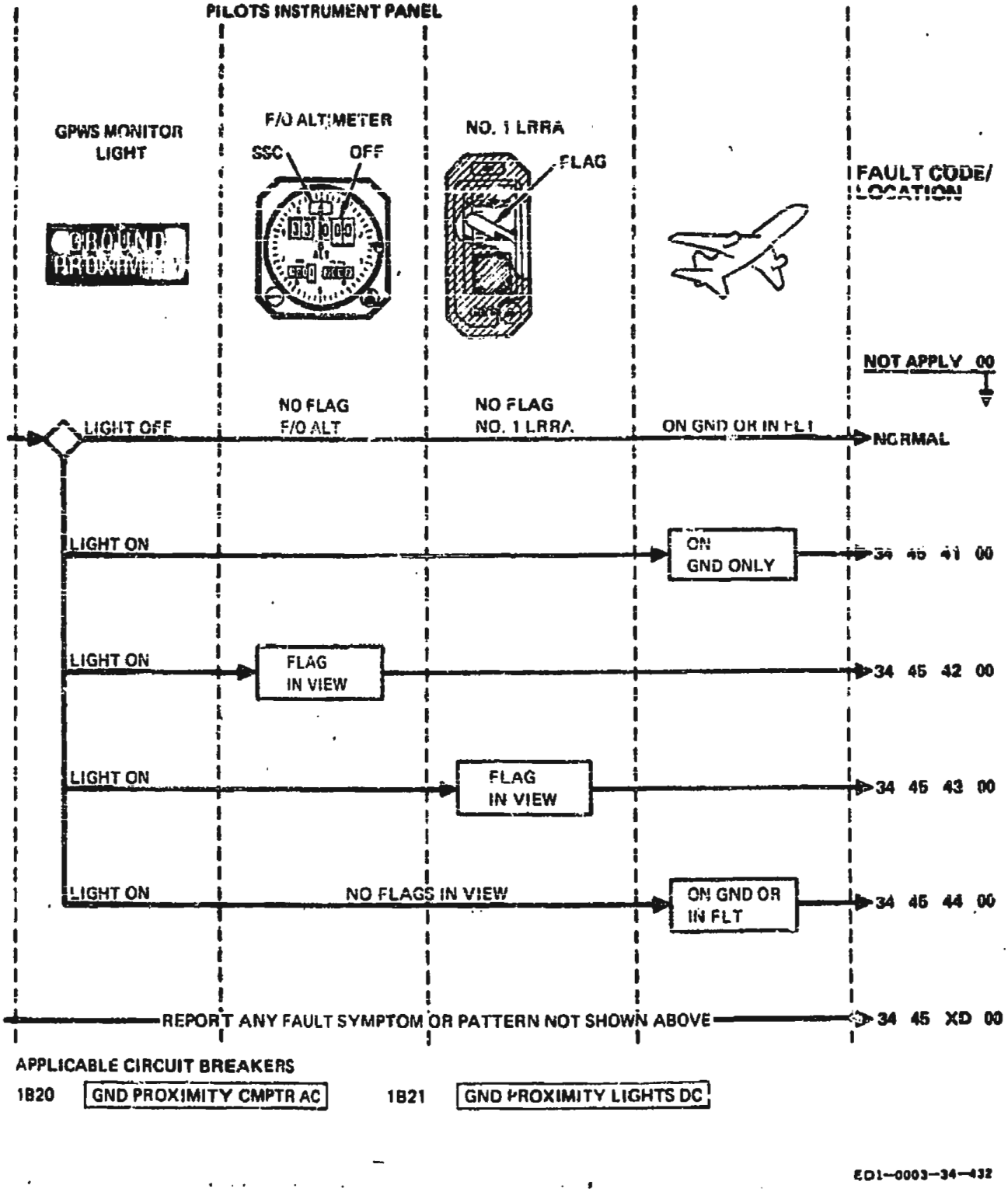
Weather Radar Test - Fault Codes
Figure 17



GPWS - Aural Warning - Fault Codes
Figure 18

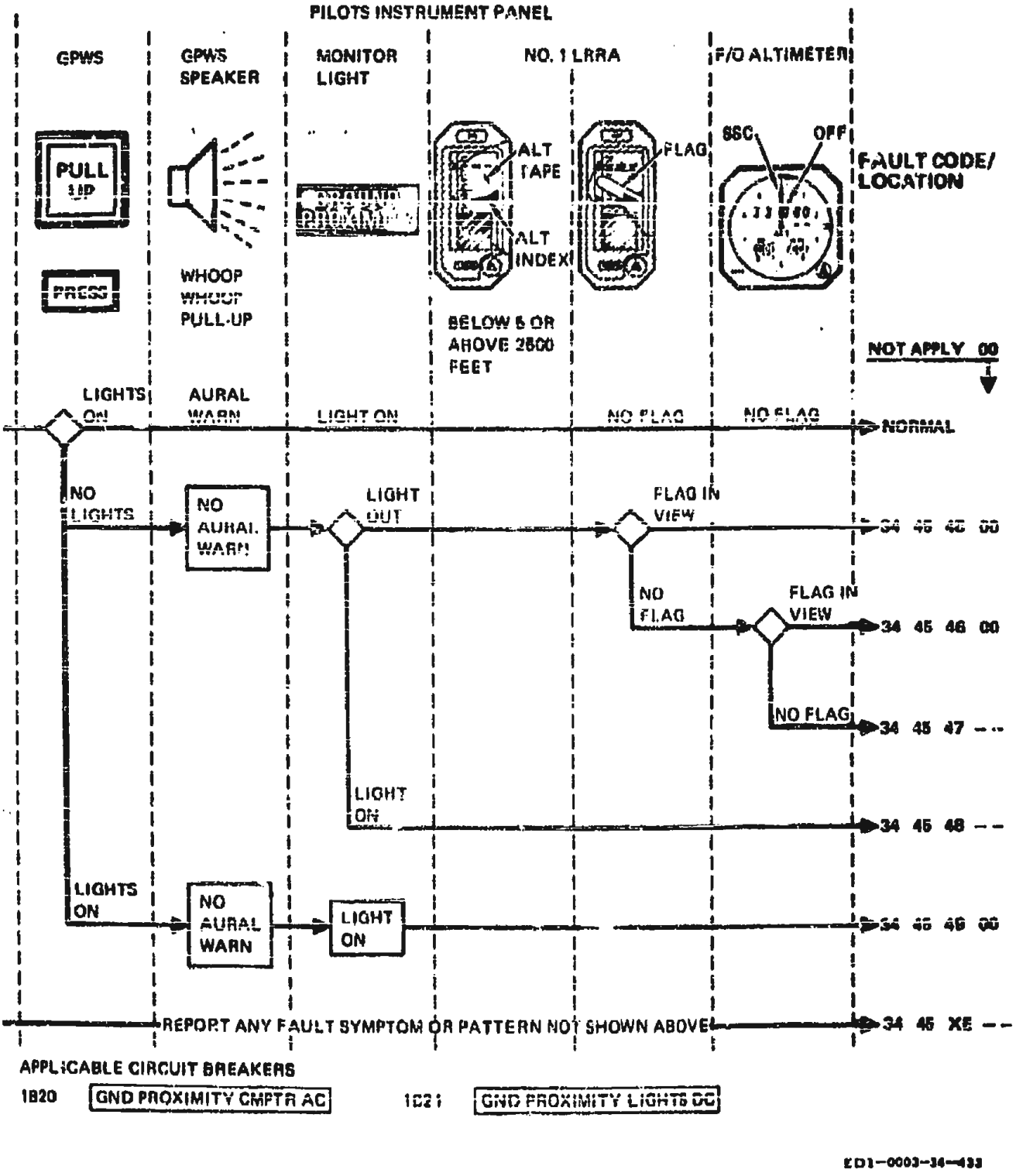


GPWS - Take-Off/Approach - Fault Codes
Figure 19

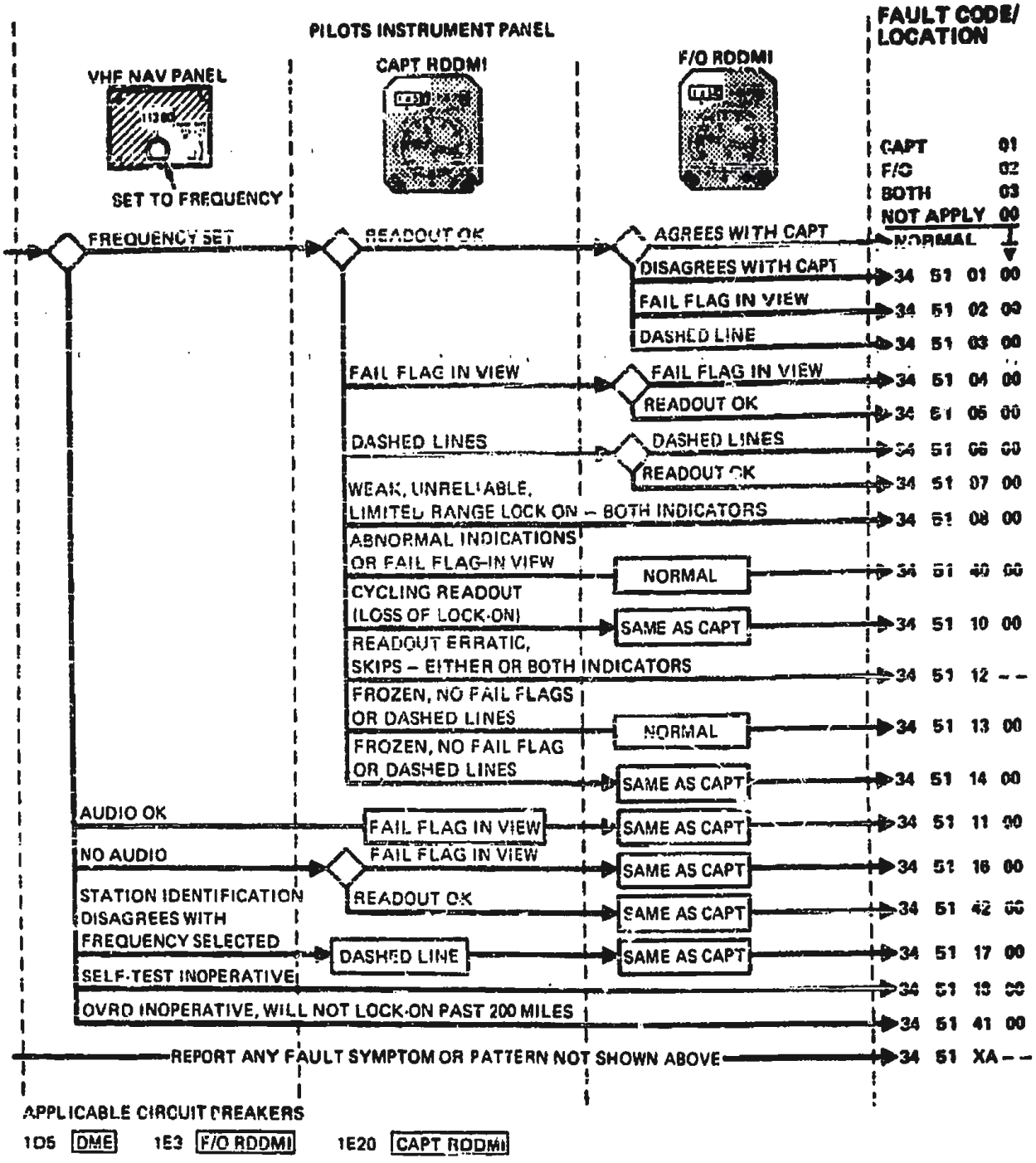


ED1-0003-34-432

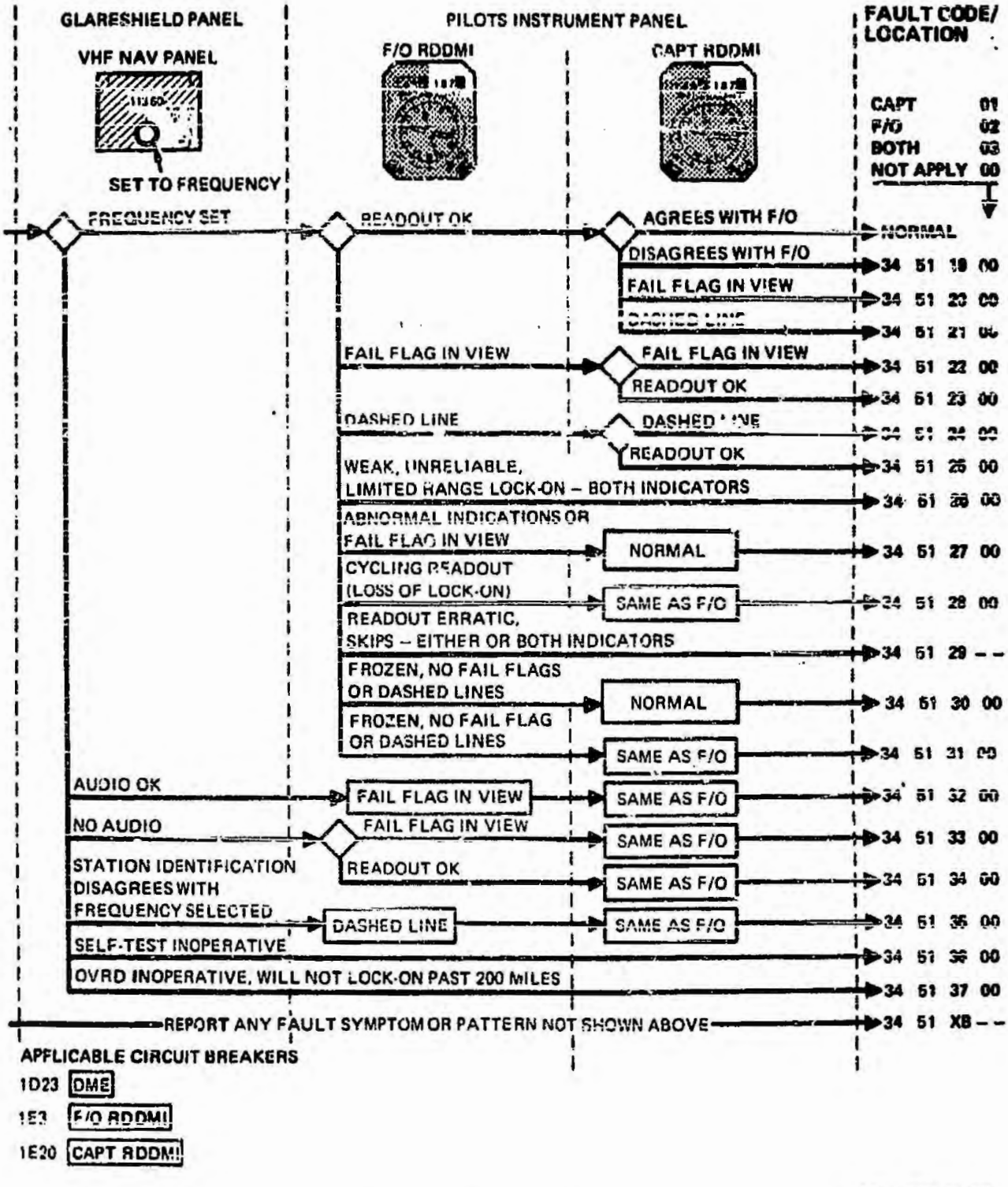
GPWS - MONITOR Light - Fault Codes
Figure 20



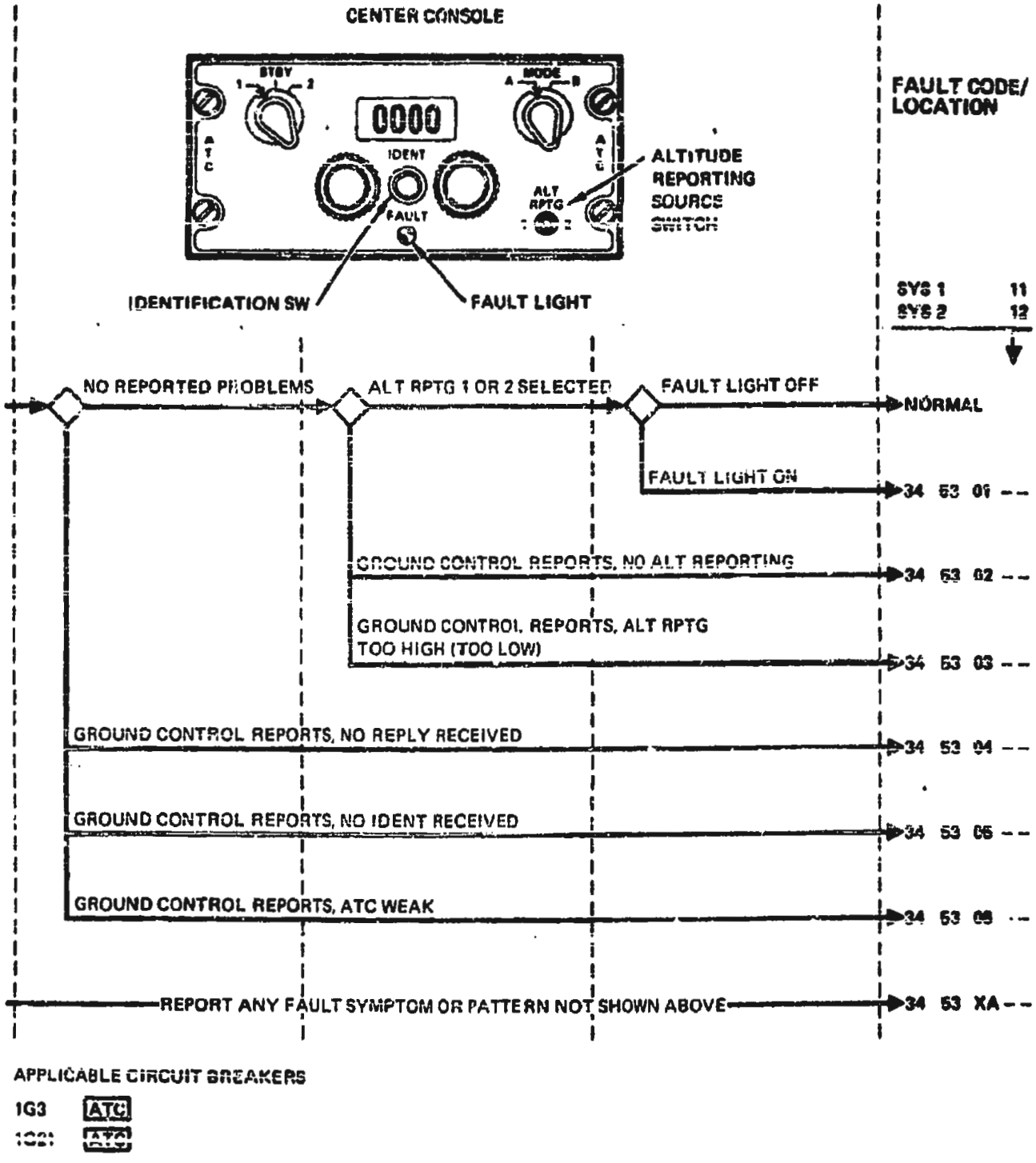
GPWS - Test - Fault Codes
Figure 21


PILOTS INSTRUMENT PANEL
VHF NAV PANEL
SET TO FREQUENCY
CAPT RDDMI
F/O RDDMI
FAULT CODE/ LOCATION
CAPT 01
F/O 02
BOTH 03
NOT APPLY 00
FREQUENCY SET
READOUT OK
AGREES WITH CAPT
NORMAL
DISAGREES WITH CAPT 34 51 01 00
FAIL FLAG IN VIEW 34 51 02 00
DASHED LINE 34 51 03 00
FAIL FLAG IN VIEW
FAIL FLAG IN VIEW 34 51 04 00
READOUT OK 34 51 05 00
DASHED LINES
DASHED LINES 34 51 06 00
READOUT OK 34 51 07 00
WEAK, UNRELIABLE, LIMITED RANGE LOCK ON – BOTH INDICATORS 34 51 08 00
ABNORMAL INDICATIONS OR FAIL FLAG-IN VIEW
NORMAL 34 51 40 00
CYCLING READOUT (LOSS OF LOCK-ON)
SAME AS CAPT 34 51 10 00
READOUT ERRATIC, SKIPS – EITHER OR BOTH INDICATORS 34 51 12 – –
FROZEN, NO FAIL FLAGS OR DASHED LINES
NORMAL 34 51 13 00
FROZEN, NO FAIL FLAG OR DASHED LINES
SAME AS CAPT 34 51 14 00
AUDIO OK
FAIL FLAG IN VIEW
SAME AS CAPT 34 51 11 00
NO AUDIO
FAIL FLAG IN VIEW
SAME AS CAPT 34 51 16 00
STATION IDENTIFICATION DISAGREES WITH FREQUENCY SELECTED
READOUT OK
SAME AS CAPT 34 51 42 00
DASHED LINE
SAME AS CAPT 34 51 17 00
SELF-TEST INOPERATIVE 34 51 18 00
OVRD INOPERATIVE, WILL NOT LOCK-ON PAST 200 MILES 34 51 41 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE 34 51 XA – –
APPLICABLE CIRCUIT BREAKERS
1D5 DME 1E3 F/O RDDMI 1E20 CAPT RDDMI
ED1-0011-34-382

DME NO. 1 - Fault Codes
Figure 22

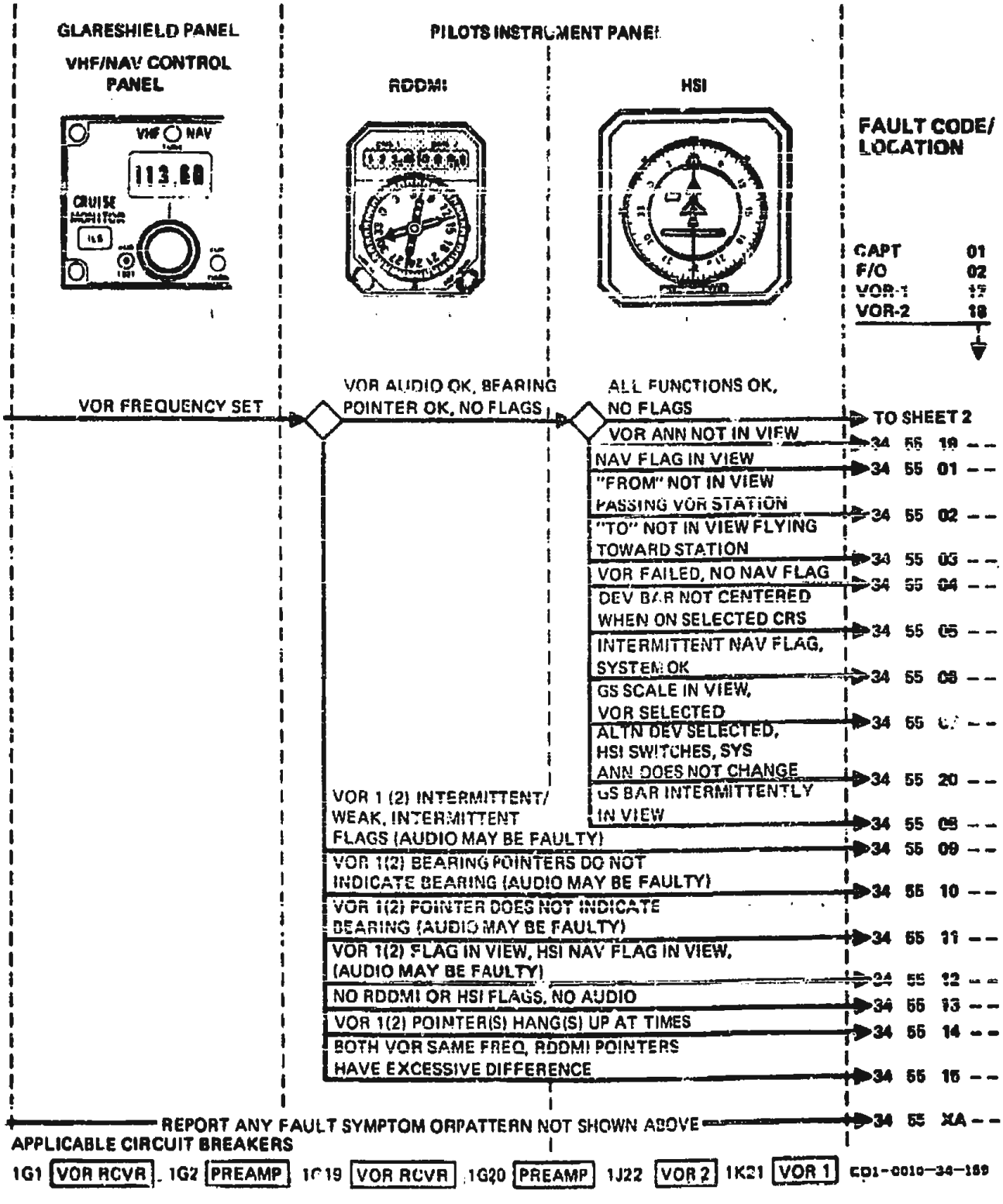


DME NO. 2 - Fault Codes
Figure 23



ED1-0005-34-316

ATC Transponder - Fault Codes
Figure 24

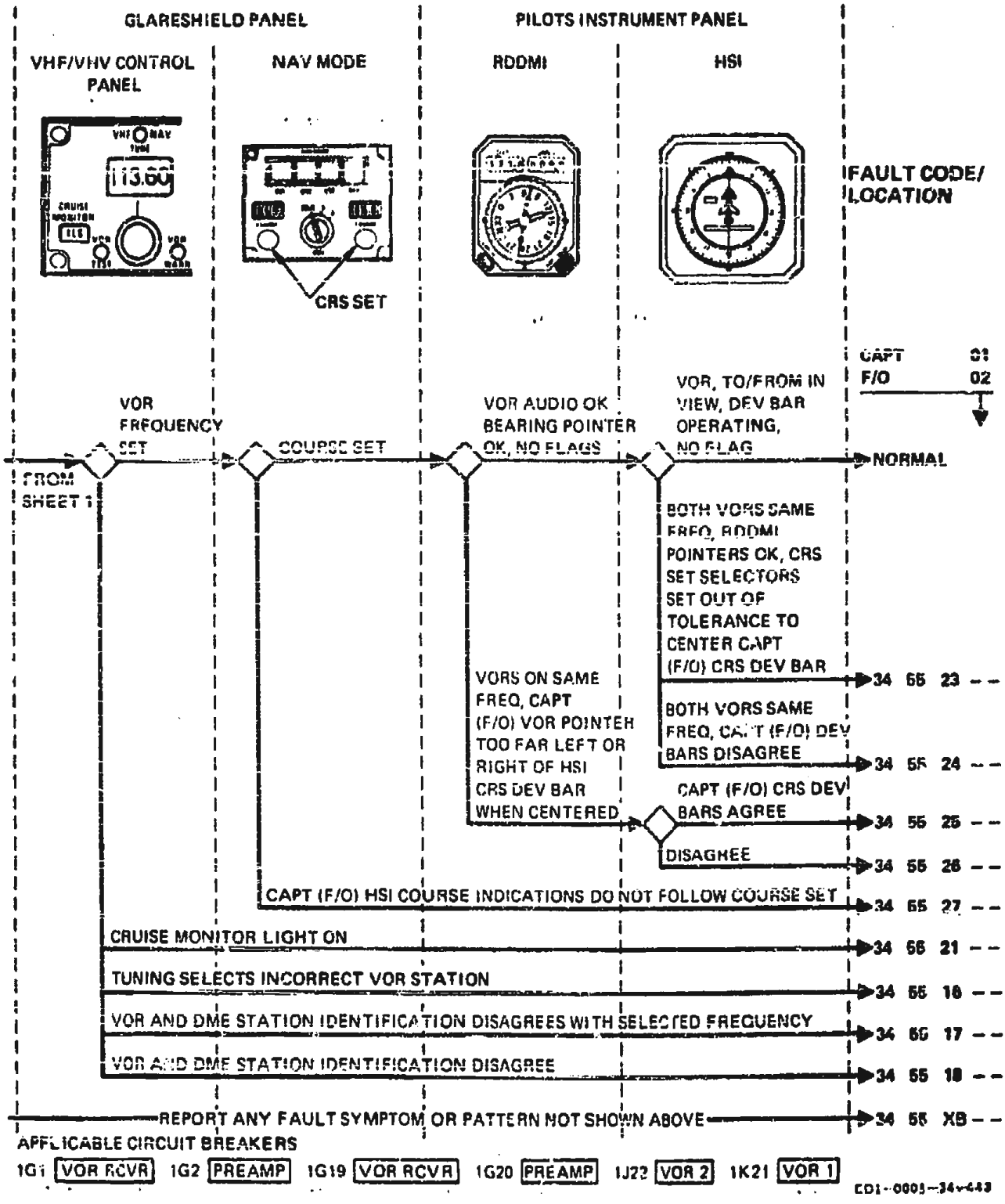

GLARESHIELD PANEL
VHF/NAV CONTROL PANEL
PILOTS INSTRUMENT PANEL
RDDMI
HSI
FAULT CODE/ LOCATION
CAPT 01
F/O 02
VOR-1 17
VOR-2 18
VOR FREQUENCY SET
VOR AUDIO OK, BEARING POINTER OK, NO FLAGS
ALL FUNCTIONS OK, NO FLAGS
TO SHEET 2
VOR ANN NOT IN VIEW 34 55 19
NAV FLAG IN VIEW 34 55 01
"FROM" NOT IN VIEW PASSING VOR STATION 34 55 02
"TO" NOT IN VIEW FLYING TOWARD STATION 34 55 03
VOR FAILED, NO NAV FLAG 34 55 04
DEV BAR NOT CENTERED WHEN ON SELECTED CRS 34 55 05
INTERMITTENT NAV FLAG, SYSTEM OK 34 55 06
GS SCALE IN VIEW, VOR SELECTED 34 55
ALTN DEV SELECTED, HSI SWITCHES, SYS ANN DOES NOT CHANGE 34 55 20
GS BAR INTERMITTENTLY IN VIEW 34 55 08
VOR 1 (2) INTERMITTENT/ WEAK, INTERMITTENT FLAGS (AUDIO MAY BE FAULTY) 34 55 09
VOR 1(2) BEARING POINTERS DO NOT INDICATE BEARING (AUDIO MAY BE FAULTY) 34 55 10
VOR 1(2) POINTER DOES NOT INDICATE BEARING (AUDIO MAY BE FAULTY) 34 55 11
VOR 1(2) FLAG IN VIEW, HSI NAV FLAG IN VIEW, (AUDIO MAY BE FAULTY) 34 55 12
NO RDDMI OR HSI FLAGS, NO AUDIO 34 55 13
VOR 1(2) POINTER(S) HANG(S) UP AT TIMES 34 55 14
BOTH VOR SAME FREQ, RDDMI POINTERS HAVE EXCESSIVE DIFFERENCE 34 55 15
REPORT ANY FAULT SYMPTOM ORPATTERN NOT SHOWN ABOVE 34 55 XA
APPLICABLE CIRCUIT BREAKERS
1G1 VOR RCVR 1G2 PREAMP 1G19 VOR RCVR 1G20 PREAMP 1J22 VOR 2 1K21 VOR 1
CD1-0010-34-189

VOR (Sheet 1) - Fault Codes
Figure 25

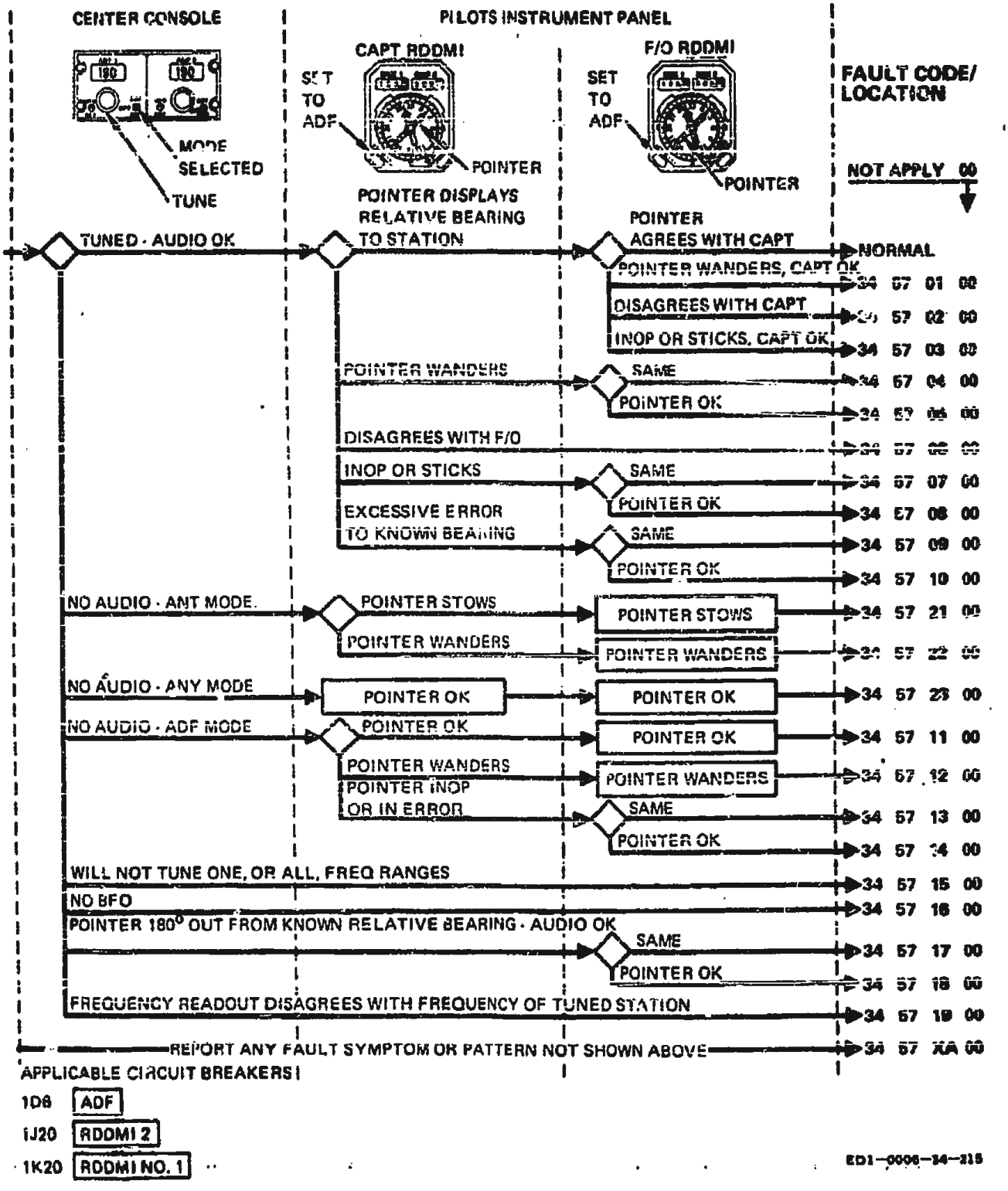
R EFFECTIVITY: ALL

R 050B

34-FAULT CODE DIAGRAM


GLARESHIELD PANEL
PILOTS INSTRUMENT PANEL
VHF/VHV CONTROL PANEL
NAV MODE
RDDMI
HSI
FAULT CODE/ LOCATION
CRS SET
CAPT 01
F/O 02
VOR FREQUENCY SET
COURSE SET
VOR AUDIO OK BEARING POINTER OK, NO FLAGS
VOR, TO/FROM IN VIEW, DEV BAR OPERATING, NO FLAG
NORMAL
FROM SHEET 1
BOTH VORS SAME FREQ, RDDMI POINTERS OK, CRS SET SELECTORS SET OUT OF TOLERANCE TO CENTER CAPT (F/O) CRS DEV BAR
34 55 23 - -
VORS ON SAME FREQ, CAPT (F/O) VOR POINTER TOO FAR LEFT OR RIGHT OF HSI CRS DEV BAR WHEN CENTERED
BOTH VORS SAME FREQ, CAPT (F/O) DEV BARS DISAGREE
34 55 24 - -
CAPT (F/O) CRS DEV BARS AGREE
34 55 25 - -
DISAGREE
34 55 26 - -
CAPT (F/O) HSI COURSE INDICATIONS DO NOT FOLLOW COURSE SET
34 55 27 - -
CRUISE MONITOR LIGHT ON
34 55 21 - -
TUNING SELECTS INCORRECT VOR STATION
34 55 16 - -
VOR AND DME STATION IDENTIFICATION DISAGREES WITH SELECTED FREQUENCY
34 55 17 - -
VOR AND DME STATION IDENTIFICATION DISAGREE
34 55 18 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
34 55 XB - -
APPLICABLE CIRCUIT BREAKERS
1G1 VOR RCVR 1G2 PREAMP 1G19 VOR RCVR 1G20 PREAMP 1J22 VOR 2 1K21 VOR 1
CD1-0003-34v443

VOR (Sheet 2) - Fault Codes
Figure 26



Automatic Direction Finder - Fault Codes
Figure 27

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 XA __	1. An AIRSPEED/MACH fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-14-00 Fig. 103 Block 1 34-14-00 Fig. 106 Block 1
R 34 14 XB __	1. An AIRSPEED/MACH fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 34-14-00 Fig. 104 Block 1 34-14-00 Fig. 106 Block 1
34 14 XC __	1. An ALTIMETER fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-14-00 Fig. 104 Block 1 34-14-00 Fig. 106 Block 1
34 14 XD __	1. A VSI fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-14-00 Fig. 105 Block 1 34-14-00 Fig. 106 Block 1
34 14 XE __	1. A TAS/SAT fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-14-00 Fig. 106 Block 1 34-14-00 Fig. 107 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 16 XA __	1. An Instrument Comparison Monitor Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-16-00 Fig. 106 thru Fig. 117 Block 1
R 34 19 XA 00	1. A Windshear System fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 34-19-00 Fig. 103 (Sheet 1) Block 1
34 21 XA __	1. An Attitude Reference System fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-21-00 Fig. 103 thru Fig. 107 Block 1
34 22 XA __	1. An Heading System fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-22-00 Fig. 103 Block 1
34 32 XA __	1. A Radio Altimeter fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-32-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 33 XA __	1. An ILS fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-33-00 Fig. 103 thru Fig. 106 Block 1
34 35 XA __	1. A Marker Beacon fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-35-00 Fig. 103 and 104 Block 1
34 43 XA __	1. An INS - (Action/Malfunction Codes) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-43-00 Fig. 103
34 43 XD __	1. An INS - (Non Action/Malfunction Code Faults) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-43-00 Fig. 103 thru Fig. 121 Block 1
34 44 XA __	1. A Weather Radar fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-44-00 Fig 108, 109 and 111 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 XB __	1. A Weather Radar fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-44-00 Fig. 104, 105, 106 and 110 Block 1
34 44 XC __	1. A Weather Radar Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-44-00 Fig. 107 Block 1
34 45 XB 00	1. A GPWS - Aural Warning fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-45-00 Fig. 105 and 107 Block 1
34 45 XC 00	1. A GPWS - Take-Off/Approach fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-45-00 Fig. 108 Block 1
34 45 XD 00	1. A GPWS - MONITOR Light fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-45-00 Fig. 103 Block 1
34 45 XE __	1. A GPWS - Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 34-45-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 XA __	1. A DME NO. 1 fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-51-00 Fig. 103, 104 and 105 Block 1
34 51 XB __	1. A DME NO. 2 fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-51-00 Fig. 103, 104 and 105 Block 1
34 53 XA __	1. An ATC Transponder fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-53-00 Fig. 103, 104, 105, 106 and 107 Block 1
34 55 XA __	1. A VOR fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-55-00 Fig. 107 and 108 Block 1
34 55 XB __	1. A VOR fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-55-00 Fig. 105, 106, 107 (Sheet 3) and 108 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 57 XA 00	1. An Automatic Direction Finder fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 34-57-00 Fig. 103 and 104 Block 1
34 14 01 __	1. (01=CAPT, 02=F/O) overspeed warning (clacker) sounds outside limits. 2. 34-14-00 Fig. 104 (Sheet 3) Block 1
34 14 02 __	1. (01=CAPT, 02=F/O) indications fluctuate in unison with other air data indications. Operation normal when ALTN AS/M was selected. 2. 34-14-00 Fig. 104 (Sheet 3) Block 2
34 14 03 __	1. (01=CAPT, 02=F/O) indications fluctuate in unison with other air data indications. No change when ALTN AS/M selected. 2. 34-14-00 Fig. 104 (Sheet 3) Block 2
34 14 04 __	1. (01=CAPT, 02=F/O) Erratic airspeed indication, altimeter and VSI may or may not be affected. Indication changed when ALTN AS/M is selected. 2. 34-14-00 Fig. 104 (Sheet 3) Block 3
34 14 05 __	1. (01=CAPT, 02=F/O) Erratic airspeed indication, altimeter and VSI may or may not be affected. Indication same when ALTN AS/M selected. 2. 34-14-00 Fig. 104 (Sheet 3) Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 06 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, Vmo and/or MACH flags in view on AS/M indicator. Messages and flag out of view after selecting ALTN AS/M. 2. 34-14-00 Fig. 104 (Sheet 2) Block 5
34 14 07 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, Vmo and/or MACH flags in view on AS/M indicator before and after selecting ALTN AS/M. 2. 34-14-00 Fig. 104 (Sheet 2) Block 5
34 14 08 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, AS flag in view on AS/M indicator. Messages and flag out of view after ALTN AS/M selected. 2. 34-14-00 Fig. 104 (Sheet 2) Block 5
34 14 09 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, AS flag in view on AS/M indicator before and after selecting ALTN AS/M. 2. 34-14-00 Fig. 104 (Sheet 2) Block 5
34 14 10 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, no flags in view on AS/M indicator. State which indication, or if all indications disagree with opposite AS/M indicator. Indicators agree and COMPARATORs blank when ALTN AS/M selected. 2. 34-14-00 Fig. 104 (Sheet 2) Block 6
34 14 11 __	1. (01=CAPT, 02=F/O) AIRSPEED in view on COMPARATORs, no flags in view on AS/M indicator. State which indication, or if all indications disagree with opposite AS/M indicator. No change when ALTN AS/M selected. 2. 34-14-00 Fig. 104 (Sheet 2) Block 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 12 __	1. (44=TAS, 45=SAT, 03=BOTH) OFF flag(s) in view. 2. 34-14-00 Fig. 107 Block 1
34 14 13 __	1. (44=TAS, 45=SAT, 03=BOTH) OFF flag(s) in view intermittently. 2. 34-14-00 Fig. 107 Block 8
34 14 14 __	1. (44=TAS, 45=SAT, 03=BOTH) indication(s) stick(s) or in operative. 2. 34-14-00 Fig. 107 Block 4
34 14 15 __	1. (44=TAS, 45=SAT, 03=BOTH) fluctuate(s) in unison with other air data indications. 2. 34-14-00 Fig. 107 Block 5
34 14 16 __	1. (44=TAS, 45=SAT, 03=BOTH) indication(s) roll(s) (continuous intermittent). 2. 34-14-00 Fig. 107 Block 6
34 14 17 __	1. (44=TAS, 45=SAT, 03=BOTH) indication(s) reads high. 2. 34-14-00 Fig. 107 Block 7
34 14 18 __	1. (44=TAS, 45=SAT, 03=BOTH) indication(s) reads low. 2. 34-14-00 Fig. 107 Block 7
34 14 19 00	1. NOT USED.
34 14 20 00	1. NOT USED.
34 14 21 00	1. NOT USED.
34 14 22 00	1. NOT USED.
34 14 23 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 24 00	1. NOT USED.
34 14 25 00	1. NOT USED.
34 14 26 00	1. NOT USED.
34 14 27 00	1. NOT USED.
34 14 28 00	1. NOT USED.
34 14 29 00	1. NOT USED.
34 14 30 00	1. NOT USED.
34 14 31 00	1. Standby altimeter pointer/counter sticks or inoperative. 2. 34-14-00 Fig. 103 (Sheet 1) Block 1
34 14 32 00	1. Baro set inoperative on standby altimeter. 2. 34-14-00 Fig. 103 (Sheet 1) Block 2
34 14 33 00	1. Standby altimeter out of limits from primary altimeters. 2. 34-14-00 Fig. 103 (Sheet 1) Block 3
34 14 34 00	1. NOT USED.
34 14 35 00	1. NOT USED.
34 14 36 00	1. NOT USED.
34 14 37 00	1. NOT USED.
34 14 38 __	1. (01=CAPT, 02=F/O) servoed altimeters exceed disagreement limits; ALTITUDE annunciation on COMPARATORS in view, flags may be in view. They agree after ALTN selected. 2. 34-14-00 Fig. 103 (Sheet 1) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 39 __	1. (01=CAPT, 02=F/O) servoed altimeters exceed diagreement limits; ALTITUDE annunciation on COMPARATORS in view, flags may be in view before and after selecting ALTN ALT.
	2. 34-14-00 Fig. 103 (Sheet 1) Block 4
34 14 40 __	1. (01=CAPT, 02=F/O) servoed altimeter pointer and/or counter sticks, or inoperative. Functions smoothly after ALTN ALT selected.
	2. 34-14-00 Fig. 103 (Sheet 1) Block 5
34 14 41 __	1. (01=CAPT, 02=F/O) servoed altimeter pointer and/or counter sticks, or inoperative before and after selecting ALTN ALT.
	2. 34-14-00 Fig. 103 (Sheet 1) Block 5
34 14 42 __	1. (01=CAPT, 02=F/O) erratic altitude indications, airspeed and VSI may be affected. Indications changed when ALTN ALT selected.
	2. 34-14-00 Fig. 103 (Sheet 3) Block 1
34 14 43 __	1. (01=CAPT, 02=F/O) erratic altitude indications, airspeed and VSI may be affected. Indications did not change when ALTN ALT selected.
	2. 34-14-00 Fig. 103 (Sheet 2) Block 12
34 14 44 __	1. (01=CAPT, 02=F/O) indications fluctuate in unison with other air data indications. Operation normal after selecting ALTN ALT.
	2. 34-14-00 Fig. 103 (Sheet 2) Block 4
34 14 45 __	1. (01=CAPT, 02=F/O) indications fluctuate in unison with other air data indications. No change after selecting ALTN ALT.
	2. 34-14-00 Fig. 103 (Sheet 2) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 46 __	1. (01=CAPT, 02=F/O) SSC flag in view, Mach flag on AS/M indicator also in view. Flag goes out of view when ALTN ALT selected. 2. 34-14-00 Fig. 103 (Sheet 2) Block 2
34 14 47 __	1. (01=CAPT, 02=F/O) SSC flag in view, Mach flag on AS/M indicator also in view. Same indication before and after ALTN ALT selected. 2. 34-14-00 Fig. 103 (Sheet 2) Block 2
34 14 48 __	1. (01=CAPT, 02=F/O) OFF flag in view, altimeters may disagree and Mach - Vmo flags on AS/M indicator may be in view. Indications normal when ALTN ALT selected. 2. 34-14-00 Fig. 103 (Sheet 2) Block 1
34 14 49 __	1. (01=CAPT, 02=F/O) OFF flag in view, altimeters may disagree and Mach - Vmo flags on AS/M indicator may be in view. Same indication after ALTN ALT selected. 2. 34-14-00 Fig. 103 (Sheet 2) Block 1
34 14 50 00	1. ALTITUDE in view on INSTR COMPARATORS, no flags in view, servoed altimeters agree. 2. 34-14-00 Fig. 103 (Sheet 2) Block 3
34 14 51 00	1. NOT USED.
34 14 52 __	1. ALTITUDE in view on (01=CAPT, 02=F/O) COMPARATORS, only at high altitude, no flags in view, altimeters agree. 2. 34-14-00 Fig. 103 (Sheet 2) Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 53 __	1. ALTITUDE in view on (01=CAPT, 02=F/O) COMPARATORS during climb and/or descent, no flags in view, altimeters agree.
	2. 34-14-00 Fig. 103 (Sheet 2) Block 6
34 14 54 00	1. NOT USED.
34 14 55 00	1. Standby airspeed indicator pointer sticks or inoperative.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 1
34 14 56 00	1. Standby airspeed indicator out of limits from airspeed/Mach indicators.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 2
34 14 57 __	1. (01=CAPT, 02=F/O) airspeed/Mach indications exceed disagreement limits; flags or COMPARATOR annunciation may be in view. They agree, when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 3
34 14 58 __	1. (01=CAPT, 02=F/O) airspeed/Mach indications exceed disagreement limits; flags or COMPARATOR annunciation may be in view. No change when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 3
34 14 59 __	1. (01=CAPT, 02=F/O) Mach counter sticks or inoperative. Functions smoothly after ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 4
34 14 60 __	1. (01=CAPT, 02=F/O) Mach counter sticks or inoperative before and after selecting ALTN AS/M.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 61 __	1. (01=CAPT, 02=F/O) Airspeed pointer sticks or inoperative. Functions smoothly after ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 4
34 14 62 __	1. (01=CAPT, 02=F/O) Airspeed pointer sticks or inoperative before and after selecting ALTN AS/M.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 4
34 14 63 __	1. (01=CAPT, 02=F/O) Airspeed bug inoperative.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 5
34 14 64 __	1. (01=CAPT, 02=F/O) Vmo pointer sticks sticks or inoperative. Functions smoothly after ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 6
34 14 65 __	1. (01=CAPT, 02=F/O) Vmo pointer sticks or inoperative before and after selecting ALTN AS/M.
	2. 34-14-00 Fig. 104 (Sheet 1) Block 6
34 14 66 __	1. (01=CAPT, 02=F/O) Mach indication oscillates, indication unreliable. Indication normal when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 1
34 14 67 __	1. (01=CAPT, 02=F/O) Mach indication oscillates, indication unreliable. No change when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 68 __	1. (01=CAPT, 02=F/O) Mach flag in view, may be intermittent. Mach flag out-of-view when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 2
34 14 69 __	1. (01=CAPT, 02=F/O) Mach flag in view, may be intermittent. No change when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 2
34 14 70 __	1. (01=CAPT, 02=F/O) Vmo flag in view, Vmo pointer inoperative. Vmo flag out-of-view, Vmo pointer operative when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 3
34 14 71 __	1. (01=CAPT, 02=F/O) Vmo flag in view, Vmo pointer inoperative. No change when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 3
34 14 72 __	1. (01=CAPT, 02=F/O) Vmo flag in view, both indicator Vmo pointers agree. Vmo flag out-of-view when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 4
34 14 73 __	1. (01=CAPT, 02=F/O) Vmo flag in view, both AS/M indicator Vmo pointers agree. No change when ALTN AS/M selected.
	2. 34-14-00 Fig. 104 (Sheet 2) Block 4
34 14 74 00	1. NOT USED.
34 14 75 __	1. (01=CAPT, 02=F/O) VSI disagrees, exceeds disagreement limits - OFF flag may be in view. Indicators agree when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 76 __	1. (01=CAPT, 02=F/O) VSI disagrees, exceeds disagreement limits - OFF flag may be in view. No change when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 1
34 14 77 __	1. (01=CAPT, 02=F/O) VSI sticks at zero, OFF flag may be in view.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 2
34 14 78 __	1. (01=CAPT, 02=F/O) VSI sticks at zero, no flag in view.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 3
34 14 79 __	1. (01=CAPT, 02=F/O) intermittent flag, operation appears normal. Flag stayed out-of-view when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 5
34 14 80 __	1. (01=CAPT, 02=F/O) intermittent flag, operation appears normal. No change when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 5
34 14 81 __	1. (01=CAPT, 02=F/O) VSI pointer sticks or inoperative. Pointer functioned smoothly when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 4
34 14 82 __	1. (01=CAPT, 02=F/O) VSI pointer sticks or inoperative before and after ALTN ALT selection.
	2. 34-14-00 Fig. 105 (Sheet 1) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 83 __	1. (O1=CAPT, O2=F/O) pointer fluctuates in unison with other air data indications. Pointer stable when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 2) Block 1
34 14 84 __	1. (O1=CAPT, O2=F/O) pointer fluctuates in unison with other air data indications. No change when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 2) Block 1
34 14 85 __	1. Erratic (O1=CAPT, O2=F/O) VSI indications, altimeter and airspeed may or may not be affected. Indication changed when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 2) Block 2
34 14 86 __	1 Erratic (O1=CAPT, O2=F/O) VSI indications, altimeter and airspeed may or may not be affected. Indication same when ALTN ALT selected.
	2. 34-14-00 Fig. 105 (Sheet 2) Block 2
34 14 87 00	1. NOT USED.
34 14 88 00	1. NOT USED.
34 14 89 00	1. NOT USED.
34 14 90 00	1. NOT USED.
34 14 91 00	1. NOT USED.
34 14 92 00	1. NOT USED.
34 14 93 00	1. NOT USED.
34 14 94 00	1. NOT USED.
34 14 95 00	1. NOT USED.
34 14 96 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 14 97 __	1. (01=CAPT, 02=F/O) AS MON in view on COMPARATORs. (It is normal for both COMPARATORs to display together).
	2. 34-16-00 Fig. 109 Block 1
34 14 98 __	1. (01=CAPT, 02=F/O) ALT MON in view on COMPARATORS. It is normal for both COMPARATORS to display together).
	2. 34-16-00 Fig. 107 Block 1
34 16 01 00	1. NOT USED.
34 16 02 00	1. NOT USED.
34 16 03 00	1. DANA light and VERTICAL GYRO 3 annunciator on.
	2. 34-16-00 Fig. 112 Block 1
34 16 04 00	1. DANA light on, instrument comparator ATTITUDE message in view.
	2. 34-16-00 Fig. 111 Block 1
34 16 05 00	1. NOT USED.
34 16 06 00	1. NOT USED.
34 16 07 00	1. NOT USED.
34 16 08 00	1. NOT USED.
34 16 09 __	1. (01=CAPT, 02=F/O) INSTR COMPARATOR 1 or 2, TEST 2 does not test.
	2. 34-16-00 Fig. 117 (Sheet 2) Block 1
34 16 10 __	1. (01=CAPT, 02=F/O) TEST 2; all monitor messages not in view.
R	2. 34-16-00 Fig. 117 (Sheet 2) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 16 11 00	1. TEST 1 pressed on both panels; ATTITUDE message out of view, others in view on both panels, but VERTICAL GYRO 3 light off.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 2
34 16 12 00	1. TEST 1 pressed on both panels; ATTITUDE messages in view on both panels, VERTICAL GYRO 3 light on.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 2
34 16 13 00	1. TEST 1 pressed on both panels; ATTITUDE message in view, VERTICAL GYRO 3 light off. off.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 2
34 16 14 00	1. TEST 1 pressed on both panels; test inoperative.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 2
34 16 15 __	1. (01=CAPT, 02=F/O) TEST 1; all messages in view on both panels, ATT flag out of view on ADI.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 1
34 16 16 __	1. (01=CAPT, 02=F/O) TEST 1; all messages not in view on both panels, ATT flag in view on ADI. view on ADI.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 1
34 16 17 __	1. (01=CAPT, 02=F/O) TEST 1; all messages not in view on both panels, ATT flag out of view on ADI.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 1
34 16 18 __	1. (01=CAPT, 02=F/O) TEST 1, inoperative.
	2. 34-16-00 Fig. 117 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 19 01 00	1. WINDSHR CMPTR light on pilots annunciator panel on with Indicated Airspeed greater than 30 knots. 2. 34-19-00 Fig. 103 (Sheet 1) Block 1
34 19 02 00	1. WINDSHR CMPTR light on pilots annunciator panel on with Indicated Airspeed 30 knots or less. 2. 34-19-00 Fig. 103 (Sheet 1) Block 1
34 21 01 __	1. DANA light comes on immediately after either AP bat handle is set to CWS or CMD from OFF. ATT flag in view on (01=CAPT, 02=F/O) ADI. (Ref. Chapter 22 for Fault Code diagram.) 2. 34-21-00 Fig. 104 Block 1
34 21 02 00	1. DANA light comes on immediately after either AP bat handle is set to CWS or CMD from OFF. VERTICAL GYRO 3 light is on. (Ref. Chapter 22 for Fault Code diagram.) 2. 34-21-00 Fig. 106 Block 1
34 21 03 00	1. DANA light on, Capt and F/O ADI horizons disagree more than 4 degrees in (pitch and/or roll) attitude. 2. 34-21-00 Fig. 104 Block 1
34 21 04 00	1. OFF flag in view on standby horizon indicator. 2. 34-21-00 Fig. 103 Block 3
34 21 05 00	1. Standby horizon indicator disagrees with ADI attitude indication, flag out of view. 2. 34-21-00 Fig. 103 Block 1
34 21 06 00	1. NOT USED.
34 21 07 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 21 08 __	1. (01=CAPT, 02=F/O) ADI attitude indication disagrees with other ADI and standby horizon indicator, ATT flag in view. ADIs agree after selecting ALTN ATT. 2. 34-21-00 Fig. 104 Block 1
34 21 09 __	1. (01=CAPT, 02=F/O) ADI attitude indication disagrees with other ADI and standby horizon indicator, ATT flag in view. Selecting ALTN ATT makes no difference. 2. 34-21-00 Fig. 104 Block 1
34 21 10 __	1. (01=CAPT, 02=F/O) ADI is selected to ALTN, ATTITUDE annunciation on INSTR COMPARATOR in view. 2. 34-21-00 Fig. 105 Block 1
34 21 11 __	1. All flags in-view on (01=CAPT, 02=F/O) ADI, horizon may be rotating, CB trips. 2. 34-21-00 Fig. 107 Block 1
34 21 12 00	1. NOT USED.
34 21 13 00	1. Both INSTR COMPARATORS show ATT MON. 2. 34-16-00 Fig. 113 Block 1
34 21 14 00	1. VERTICAL GYRO light on. 2. 34-16-00 Fig. 112 Block 1
34 21 15 00	1. VERTICAL GYRO 3 light on during turn, goes off after a few seconds. (Not valid with INS-3 installed). 2. 34-16-00 Fig. 112 Block 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 22 01 00	1. No HDG flags in view, No. 1 and No. 2 systems disagree. HEADING annunciator may be in view. Sync indicators show null, heading cards are slaving. Selecting ALTN HDG, HSIs, agree. 2. 34-22-00 Fig. 103 (Sheet 1) Block 1
34 22 02 00	1. NOT USED.
34 22 03 00	1. NOT USED
34 22 04 __	1. No HDG flags in view. (01=CAPT, 02=F/O) Sync indicator not nulled and associated heading card drifts for no apparent reason. No. 1 and 2 systems disagree (abnormal). 2. 34-22-00 Fig. 103 (Sheet 2) Block 20
34 22 05 __	1. (01=Capt, 02=F/O) HSI HDG flags not in view, other sides RDDMI HDG flag in view. 2. 34-22-00 Fig. 103 (Sheet 2) Block 15
34 22 06 __	1. (01=CAPT, 02=F/O) HSI HDG flag not in view, RDDMIs OK. State any abnormality such as wrong heading displayed, continuous slewing, sticking, etc. Selecting ALTN HDG, HSI OK. 2. 34-22-00 Fig. 103 (Sheet 2) Block 16
34 22 07 __	1. (01=CAPT, 02=F/O) HSI HDG flag in view, RDDMIs OK. 2. 34-22-00 Fig. 103 (Sheet 2) Block 18

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 22 08 __	1. (01=CAPT, 02=F/O) HSI and other sides RDDMI HDG flags in view. Selecting DG mode, HDG flags go out of view. 2. 34-22-00 Fig. 103 (Sheet 1) Block 7
34 22 09 __	1. (01=CAPT, 02=F/O) HSI and other sides RDDMI HDG flags in view. Selecting DG mode, no change. 2. 34-22-00 Fig. 103 (Sheet 2) Block 15
34 22 10 00	1. No heading flags in view. No. 1 and 2 systems disagree. HEADING annunciator may be in view. Sync indicators may show null, heading cards are slaving. Selecting ALTN HDG, no change. 2. 34-22-00 Fig. 103 (Sheet 1) Block 1
34 22 11 __	1. (01=CAPT, 02=F/O) HSI HDG flag not in view, RDDMIs OK. State any abnormality such as wrong heading displayed, continuous slewing, sticking, etc. Selecting ALTN HDG, no change. 2. 34-22-00 Fig. 103 (Sheet 2) Block 17
34 22 12 00	1. NOT USED.
34 22 13 00	1. Standby compass disagrees with HSI/RDDMI compass cards. 2. 34-22-00 Fig. 103 (Sheet 2) Block 5
34 22 14 00	1. Standby compass lighting faulty. 2. 34-22-00 Fig. 103 (Sheet 2) Block 6
34 22 15 00	1. NOT USED.
34 22 16 00	1. NOT USED.
34 22 17 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 22 18 00	1. NOT USED.
34 22 19 00	1. NOT USED.
34 22 20 00	1. NOT USED.
34 22 21 00	1. NOT USED.
34 22 22 00	1. NOT USED.
34 22 23 00	1. NOT USED.
34 22 24 00	1. NOT USED.
34 22 25 00	1. NOT USED.
34 22 26 00	1. No HDG flags in view, HDG MON annunciator in view on comparator warning panel. 2. 34-16-00 Fig. 115 Block 1
34 32 01 __	1. Radio Altitude Indicator on (01=CAPT, 02=F/O) ADI disagrees with Radio Altitude Indicator tape. 2. 34-32-00 Fig. 103 (Sheet 1) Block 2
34 32 02 __	1. Shutter covers (01=CAPT, 02=F/O) radio altitude indication on ADI below 200-feet. 2. 34-32-00 Fig. 103 (Sheet 1) Block 3
34 32 03 __	1. (01=CAPT, 02=F/O) DH light on steady, flag in view sometimes above 2500-feet. 2. 34-32-00 Fig. 103 (Sheet 3) Block 6
34 32 04 __	1. (01=CAPT, 02=F/O) Radio Altitude Indicator DH light inoperative, ADI DH light OK. 2. 34-32-00 Fig. 103 (Sheet 1) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 32 05 __	1. (01=CAPT, 02=F/O) no audio tone at 50-feet above DH setting, descending below 500-feet.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 6
34 32 06 __	1. (01=CAPT, 02=F/O) DH light comes on at random.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 7
34 32 07 __	1. (01=CAPT, 02=F/O) Radio Altitude Indicator flag in view, system may or may not be operative (state which).
	2. 34-32-00 Fig. 103 (Sheet 3) Block 1
34 32 08 __	1. (01=CAPT, 02=F/O) Radio Altitude Indicator flag in view at all times above 2500-feet.
	2. 34-32-00 Fig. 103 (Sheet 3) Block 2
34 32 09 __	1. Indications on (01=CAPT, 02=F/O) Radio Altitude Indicator disagrees with other indicator. If possible, determine which system is faulty and indicate along with fault code.
	2. 34-32-00 Fig. 103 (Sheet 3) Block 3
34 32 10 __	1. (01=CAPT, 02=F/O) Radio Altitude Indicator tape does not move.
	2. 34-32-00 Fig. 103 (Sheet 3) Block 5
34 32 11 __	1. (01=CAPT, 02=F/O) ADI DH light inoperative, OK on Radio Altitude Indicator.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 2
34 32 12 00	1. NOT USED.
34 32 13 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 32 14 __	1. DH lights on (01=CAPT, 02=F/O) ADI and Radio Altitude Indicator (same side) inoperative.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 2
34 32 15 __	1. (01=CAPT, 02=F/O) DH counter and bug disagree.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 3
34 32 16 __	1. (01=CAPT, 02=F/O) DH counter bad, sticks.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 4
34 32 17 __	1. (01=CAPT, 02=F/O) DH bug and altitude tape indications disagree.
	2. 34-32-00 Fig. 102 (Sheet 2) Block 5
34 32 18 __	1. (01=CAPT, 02=F/O) Radio Altitude Indicator tape sticks.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 4
34 32 19 00	1. NOT USED.
34 32 20 __	1. (01=CAPT, 02=F/O) no 1000-Hz audio beep descending through 500-feet.
	2. 34-32-00 Fig. 103 (Sheet 2) Block 1
34 33 01 __	1. (01=CAPT, 02=F/O) ADI GATE flag in view, HSI GS indication OK.
	2. 34-33-00 Fig. 103 Block 1
34 33 02 __	1. (01=CAPT, 02=F/O) approach gate always in view. GATE flag intermittent.
	2. 34-33-00 Fig. 103 Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 33 03 __	1. (01=CAPT, 02=F/O) ADI approach gate inoperative. HSI course deviation display OK.
	2. 34-33-00 Fig. 103 Block 2
34 33 04 __	1. (01=CAPT, 02=F/O) HSI course deviation bar inoperative, NAV flag in view, LOC frequency set, LOC audio OK. Selecting ALTN, operation OK.
	2. 34-33-00 Fig. 104 Block 1
34 33 05 __	1. (01=CAPT, 02=F/O) course deviation bar and/or ADI approach gate fluctuates rapidly, NAV flag out of view. Selecting ALTN, operation OK.
	2. 34-33-00 Fig. 104 Block 2
34 33 06 __	1. (01=CAPT, 02=F/O) course deviation bar disagrees with ADI approach gate.
	2. 34-33-00 Fig. 104 Block 3
34 33 07 __	1. (01=CAPT, 02=F/O) HSI GS pointer disagrees with ADI approach gate, no flags in view.
	2. 34-33-00 Fig. 104 Block 4
34 33 08 __	1. (01=CAPT, 02=F/O) HSI GS pointer inoperative. Selecting ALTN, operation OK.
	2. 34-33-00 Fig. 104 Block 5
34 33 09 __	1. (01=CAPT, 02=F/O) HSI GS flag in view, LOC frequency set and LOC audio present. Selecting ALTN, operation OK.
	2. 34-33-00 Fig. 104 Block 6
34 33 10 __	1. (01=CAPT, 02=F/O) VHF NAV control panel set to LOC frequency, no audio present.
	2. 34-33-00 Fig. 105 Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 33 11 __	1. (01=CAPT, 02=F/O) ILS station identification audio disagrees with selected LOC frequency. 2. 34-33-00 Fig. 105 Block 3
34 33 12 __	1. (01=CAPT, 02=F/O) selecting LOC frequency does not cause NAV to go out of view on HSI and ILS come into view. 2. 34-33-00 Fig. 105 Block 2
34 33 13 00	1. NOT USED.
34 33 14 00	1. NOT USED.
34 33 15 00	1. NOT USED.
34 33 16 00	1. NOT USED.
34 33 17 00	1. NOT USED.
34 33 18 00	1. NOT USED.
34 33 19 __	1. (01=CAPT, 02=F/O) HSI course deviation bar inoperative, NAV flag in view, LOC frequency set, LOC audio OK. Selecting ALTN, no change. 2. 34-33-00 Fig. 104 Block 1
34 33 20 __	1. (01=CAPT, 02=F/O) course deviation bar and/or ADI approach gate fluctuates rapidly, NAV flag out of view. Selecting ALTN, no change. 2. 34-33-00 Fig. 104 Block 2
34 33 21 __	1. (01=CAPT, 02=F/O) HSI GS pointer inoperative. Selecting ALTN, no change. 2. 34-33-00 Fig. 104 Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 33 22 __	1. (01=CAPT, 02=F/O) HSI GS flag in view, LOC frequency set and LOC audio present. Selecting ALTN, no change.
	2. 34-33-00 Fig. 104 Block 6
34 35 01 00	1. Sensitivity does not change as selected by sensitivity switch on center console.
	2. 34-35-00 Fig. 104 Block 2
34 35 02 00	1. NOT USED.
34 35 03 __	1. (01=CAPT, 02=F/O) marker beacon lights OK, no audio. Lights OK on ADI.
	2. 34-35-00 Fig. 103 Block 1
34 35 04 __	1. One or more (01=CAPT, 02=F/O) ADI Marker beacon lights inoperative. Marker beacon light assembly OK.
	2. 34-35-00 Fig. 103 Block 1
34 35 05 __	1. One or two (01=CAPT, 02=F/O) marker beacon lights inoperative, ADI lights OK, audio OK.
	2. 34-35-00 Fig. 103 Block 1
34 35 06 __	1. One or two lights inoperative on (01=CAPT, 02=F/O) marker beacon light assembly and ADI (same side), audio OK.
	2. 34-35-00 Fig. 104 Block 1
34 35 07 __	1. One or two lights inoperative on (01=CAPT, 02=F/O) marker beacon light assembly and ADI (same side), no audio.
	2. 34-35-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 35 08 __	1. All (01=CAPT, 02=F/O) marker beacon assembly lights inoperative, ADI lights OK. 2. 34-35-00 Fig. 103 Block 1
34 35 09 __	1. All (01=CAPT, 02=F/O) marker beacon and ADI lights inoperative, audio OK. 2. 34-35-00 Fig. 103 Block 1
34 35 10 __	1. All (01=CAPT, 02=F/O) marker beacon, ADI (same side) lights and audio inoperative. 2. 34-35-00 Fig. 103 Block 1
34 43 01 00	1. NOT USED.
34 43 02 00	1. NOT USED.
34 43 03 00	1. NOT USED.
34 43 04 00	1. NOT USED.
34 43 05 00	1. NOT USED.
34 43 06 00	1. NOT USED.
34 43 07 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 04, malfunction Codes 18, 40, 41, 43, 45, 57, 60 or 61 and WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 08 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 01, malfunction Codes 37, 38 or 39, WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 09 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 01, malfunction Codes 33, 34, 35 or 36 and WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 10 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 02, malfunction codes 13, 14, 31, 32, 42, 50, 59 or 63 and WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 11 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 03, malfunction Codes 22, 23, 24, 25 or 26 and WARN light off. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 12 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 02, malfunction Codes 15 or 62, WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 13 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 02, malfunction Code 56, WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 14 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 06, malfunction Code 43, WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 15 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Action Code 06, malfunction Code 58, WARN light on. 2. 34-43-00 Fig. 103 (Sheet 2)
34 43 16 00	1. NOT USED.
34 43 17 00	1. NOT USED.
34 43 18 00	1. NOT USED.
34 43 19 00	1. NOT USED.
34 43 20 00	1. NOT USED.
34 43 21 00	1. NOT USED.
34 43 22 00	1. NOT USED.
34 43 23 00	1. NOT USED.
34 43 24 00	1. NOT USED.
34 43 25 00	1. NOT USED.
34 43 26 00	1. NOT USED.
34 43 27 00	1. NOT USED.
34 43 28 00	1. NOT USED.
34 43 29 00	1. NOT USED.
34 43 30 00	1. NOT USED.
34 43 31 00	1. NOT USED.
34 43 32 00	1. NOT USED.
34 43 33 00	1. NOT USED.
34 43 34 00	1. NOT USED.
34 43 35 00	1. NOT USED.

R EFFECTIVITY: ALL
R
0508

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 36 00	1. NOT USED.
34 43 37 00	1. NOT USED.
34 43 38 00	1. NOT USED.
34 43 39 00	1. NOT USED.
34 43 40 00	1. NOT USED.
34 43 41 00	1. NOT USED.
34 43 42 00	1. NOT USED.
34 43 43 00	1. NOT USED.
34 43 44 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) NAV flags in view on HSI; when ALTN RNAV selected, no change. 2. 34-43-00 Fig. 121 Block 5
34 43 45 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) HSI system annunciation is faulty. 2. 34-43-00 Fig. 104 (Sheet 1) Block 2
34 43 46 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) HSI source annunciation is faulty. 2. 34-43-00 Fig. 104 (Sheet 1) Block 2
34 43 47 00	1. NOT USED.
34 43 48 __	1. (11=SYS 1, 12=SYS 2, 03=Sys 3) INS will not turn on. 2. 34-43-00 Fig. 121 Block 6
34 43 49 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) READY NAV does not come on within reasonable time. 2. 34-43-00 Fig. 104 (Sheet 1) Block 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 50 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Lamps or display on CDU and MSU will not come on when TEST is pressed.
	2. 34-43-00 Fig. 109 Block 1
34 43 51 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Panel lighting faulty.
	2. 34-43-00 Fig. 106 Block 1
34 43 52 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) FROM/TO display does not come on.
	2. 34-43-00 Fig. 104 (Sheet 2) Block 3
34 43 53 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) INSERT Key does not come on.
	2. 34-43-00 Fig. 104 (Sheet 2) Block 4
34 43 54 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Digital displays are erratic while loading and displaying Performance Index (PI).
	2. 34-43-00 Fig. 104 (Sheet 2) Block 5
34 43 55 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Noncritical malfunction codes displayed.
	2. 34-43-00 Fig. 111 Block 1
34 43 56 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Present position coordinates will not load, INSERT Key remains on.
	2. 34-43-00 Fig. 104 (Sheet 2) Block 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 57 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Present position coordinates load, INSERT Key not on, data display does not show inserted latitude-longitude. WARN light may be on.
	2. 34-43-00 Fig. 104 (Sheet 2) Block 7
34 43 58 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) present position coordinates load, INSERT annunciator is not on, data display does not show inserted latitude - longitude and WARN light is on.
	2. 34-43-00 Fig. 116 Block 1
34 43 59 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Waypoint positions will not insert, INSERT Key remains on.
	2. 34-43-00 Fig. 118 Block 4
34 43 60 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) Waypoint position display erratic.
	2. 34-43-00 Fig. 104 (Sheet 3) Block 1
34 43 61 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) NAV data is out of tolerance or erratic.
	2. 34-43-00 Fig. 104 (Sheet 3) Block 2
34 43 62 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) NAV data erratic on CDU, OK on flight instruments.
	2. 34-43-00 Fig. 104 (Sheet 3) Block 3
34 43 63 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) NAV data OK on CDU, erratic on flight instruments.
	2. 34-43-00 Fig. 104 (Sheet 3) Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 64 __	1. NAV flags in view on (01=CAPT, 02=F/O) HSI; when ALTN RNAV selected, flag out of view.
	2. 34-43-00 Fig. 121 Block 5
34 43 65 __	1. (01=CAPT, 02=F/O) HSI digital data faulty; when ALTN RNAV selected, no change.
	2. 34-43-00 Fig. 121 Block 1
34 43 66 __	1. (01=CAPT, 02=F/O) HSI digital data faulty; when ALTN RNAV selected, normal operation.
	2. 34-43-00 Fig. 121 Block 13
34 43 67 __	1. (01=CAPT, 02=F/O) HSI ALERT light faulty does not light); when ALTN RNAV selected, no change.
	2. 34-43-00 Fig. 121 Block 2
34 43 68 __	1. (01=CAPT, 02=F/O) HSI ALERT light faulty (does not light); when ALTN RNAV selected, normal operation.
	2. 34-43-00 Fig. 121 Block 10
34 43 69 __	1. (11=SYS 1, 12=SYS 2, 13=SYS 3) INS comparison (FINC) light is on.
	2. 34-43-00 Fig. 121 Block 4
34 43 70 __	1. (01=CAPT, 02=F/O) RAD/INS light(s) faulty.
	2. 34-43-00 Fig. 121 Block 3
34 43 71 __	1. BAT (battery) light on (11=SYS 1, 12=SYS 2, 13=SYS 3) MSU is on.
	2. 34-43-00 Fig. 108 Block 4
34 43 72 00	1. NOT USED.
34 43 73 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 74 00	1. NOT USED.
34 43 75 00	1. NOT USED.
34 43 76 00	1. NOT USED.
34 43 77 00	1. NOT USED.
34 43 78 00	1. NOT USED.
34 43 79 00	1. NOT USED.
34 43 80 00	1. NOT USED.
34 43 81 00	1. NOT USED.
34 43 82 00	1. NOT USED.
34 43 83 00	1. NOT USED.
34 43 84 00	1. NOT USED.
34 43 85 00	1. NOT USED.
34 43 86 00	1. NOT USED.
34 43 87 00	1. NOT USED.
34 43 88 00	1. NOT USED.
34 43 89 00	1. NOT USED.
34 43 90 00	1. NOT USED.
34 43 91 00	1. NOT USED.
34 43 92 00	1. NOT USED.
34 43 93 00	1. NOT USED.
34 43 94 00	1. NOT USED.
34 43 95 00	1. NOT USED.
34 43 96 00	1. NOT USED.

R EFFECTIVITY: ALL
R
050B

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 43 97 __	1. No display on (11=SYS 1, 12=SYS 2, 13=SYS 3) CDU with display selector in one or all positions, other systems OK.
	2. 34-43-00 Fig. 121 Block 8
34 44 01 __	1. No antenna scan on either indicator with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 107 Block 11
34 44 02 00	1. No antenna scan on either indicator. Other system not OK.
	2. 34-44-00 Fig. 107 Block 11
34 44 03 00	1. Abnormal indication on Captains indicator only. Give additional information.
	2. 34-44-00 Fig. 109 Block 1
34 44 04 00	1. Abnormal indication on F/O indicator only. Give additional information.
	2. 34-44-00 Fig. 109 Block 1
34 44 05 __	1. Indicator abnormalities on both indicators with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 109 Block 1
34 44 06 __	1. (11=SYS 1, 12=SYS 2) antenna tilt control malfunction. Other system OK.
	2. 34-44-00 Fig. 108 Block 1
34 44 07 00	1. Antenna tilt control malfunction. Other system not OK.
	2. 34-44-00 Fig. 108 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 08 __	1. (11=SYS 2, 12=SYS 2) Control panel ANT fault light on. Other system OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 09 00	1. Control panel ANT fault light on. Other system not OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 10 __	1. (11=SYS 1, 12=SYS 2) Control panel T/R fault light on. Other system OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 11 00	1. Control panel RT fault light on. Other system not OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 12 __	1. (11=SYS 1, 12=SYS) Control panel ANT and RT fault lights on. Other system OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 13 00	1. Control panel ANT and RT fault lights on. Other system not OK.
	2. 34-44-00 Fig. 111 Block 1
34 44 14 00	1. Map mode inoperative, both indicators. Other system not OK.
	2. 34-44-00 Fig. 106 Block 1
34 44 15 00	1. Contour mode inoperative, both indicators. Other system not OK.
	2. 34-44-00 Fig. 106 Block 1
34 44 16 00	1. Weak or no signal return, all modes.
	2. 34-44-00 Fig. 105 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 17 00	1. False, fixed return signals. Other system not OK.
	2. 34-44-00 Fig. 110 Block 1
34 44 18 00	1. Antenna tilt up required to eliminate ground return. Other system not OK.
	2. 34-44-00 Fig. 108 Block 1
34 44 19 00	1. Antenna stability problem, ground clutter or partial display on Captains and/or F/O indicator. Other system not OK.
	2. 34-44-00 Fig. 104 Block 1
34 44 20 00	1. Sweep stops, or sticks intermittently - all modes. Other system not OK.
	2. 34-44-00 Fig. 107 Block 8
34 44 21 00	1. No sweep on either indicator. All modes. Other system not OK.
	2. 34-44-00 Fig. 107 Block 8
34 44 22 00	1. Both indicators spoking. All modes. Other system not OK.
	2. 34-44-00 Fig. 107 Block 7
34 44 23 00	1. Only noise return to 30 - 50 miles, antenna tilt ineffective. Other system not OK.
	2. 34-44-00 Fig. 111 Block 2
34 44 24 __	1. (11=SYS 1, 12=SYS 2) Map mode inoperative, both indicators. Other system OK.
	2. 34-44-00 Fig. 106 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 25 __	1. (11=SYS 1, 12=SYS 2) Contour mode inoperative, both indicators. Other system OK.
	2. 34-44-00 Fig. 106 Block 1
34 44 26 __	1. Weak or no signal return, all modes with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 105 Block 1
34 44 27 __	1. False, fixed return signals with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 110 Block 1
34 44 28 __	1. Antenna tilt up required to eliminate ground return with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 108 Block 1
34 44 29 __	1. (11=SYS 1, 12=SYS 2) Antenna stability problem, ground clutter or partial display on indicator. Other system OK.
	2. 34-44-00 Fig. 104 Block 1
34 44 30 __	1. Sweep stops, or sticks intermittently - all modes with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 107 Block 8
34 44 31 __	1. No sweep on either indicator, all modes with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 107 Block 8
34 44 32 __	1. Both indicators spoking, all modes with (11=SYS 1, 12=SYS 2) selected. Other system OK.
	2. 34-44-00 Fig. 107 Block 7
34 44 33 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 34 00	1. NOT USED.
34 44 35 __	1. No video bands on either indicator with (11=SYS 1, 12=SYS 2) in test mode. Other system OK. 2. 34-44-00 Fig. 107 Block 3
34 44 36 00	1. No video bands on either indicator in test mode. 2. 34-44-00 Fig. 107 Block 3
34 44 37 __	1. No contour or noise bands on either indicator with (11=SYS 1, 12=SYS 2) in test mode. Other system OK. 2. 34-44-00 Fig. 107 Block 4
34 44 38 00	1. No contour or noise bands on either indicator in test mode, both systems. 2. 34-44-00 Fig. 107 Block 4
34 44 39 __	1. STC inoperative on both indicators with (11=SYS 1, 12=SYS 2) in test mode. Other system OK. 2. 34-44-00 Fig. 107 Block 5
34 44 40 00	1. STC inoperative on both indicators in test mode, both systems. 2. 34-44-00 Fig. 107 Block 5
34 44 41 00	1. NOT USED.
34 44 42 00	1. NOT USED.
34 44 43 __	1. Test pattern erratic with (11=SYS 1, 12=SYS 2) selected, varies with every sweep, both indicators. Other system OK. 2. 34-44-00 Fig. 107 Block 10

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 44 00	1. Test pattern erratic, varies with every sweep, both indicators. Switching to other system did not correct fault.
	2. 34-44-00 Fig. 107 Block 10
34 44 45 00	1. NOT USED.
34 44 46 00	1. NOT USED.
34 44 47 00	1. NOT USED.
34 44 48 __	1. (11=SYS 1, 12=SYS 2) Antenna not scanning.
	2. 34-44-00 Fig. 107 Block 11
34 44 49 __	1. (01=CAPT, 02=F/O) indicator tests bad. State problem.
	2. 34-44-00 Fig. 107 Block 1
34 44 50 __	1. No sweep on both indicators with (11=SYS 1, 12=SYS 2) in test mode. Other system OK.
	2. 34-44-00 Fig. 107 Block 8
34 44 51 00	1. No sweep on both indicators in test mode, both systems. Other system same.
	2. 34-44-00 Fig. 107 Block 8
34 44 52 __	1. Both indicators spoking with (11=SYS 1, 12=SYS 2) in test mode. Other system OK.
	2. 34-44-00 Fig. 107 Block 7
34 44 53 00	1. Both indicators spoking in test mode. Other system same.
	2. 34-44-00 Fig. 107 Block 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 44 54 __	1. (11=SYS 1, 12=SYS 2) Only noise return to 30 - 50 miles, antenna tilt ineffective. Other system OK. 2. 34-44-00 Fig. 111 Block 2
34 44 55 00	1. Indicator abnormalities on both indicators, Other system not OK. 2. 34-44-00 Fig. 109 Block 1
34 45 01 00	1. NOT USED.
34 45 02 00	1. NOT USED.
34 45 03 00	1. NOT USED.
34 45 04 00	1. NOT USED.
34 45 05 00	1. NOT USED.
34 45 06 00	1. NOT USED.
34 45 07 00	1. NOT USED.
34 45 08 00	1. NOT USED.
34 45 09 00	1. NOT USED.
34 45 10 00	1. NOT USED.
34 45 11 00	1. NOT USED.
34 45 12 00	1. NOT USED.
34 45 13 00	1. NOT USED.
34 45 14 00	1. NOT USED.
34 45 15 00	1. NOT USED.
34 45 16 00	1. NOT USED.
34 45 17 00	1. NOT USED.

R EFFECTIVITY: ALL
R
050B

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 45 18 00	1. NOT USED.
34 45 19 00	1. NOT USED.
34 45 20 00	1. NOT USED.
34 45 21 00	1. NOT USED.
34 45 22 00	1. NOT USED.
34 45 23 00	1. NOT USED.
34 45 24 00	1. NOT USED.
34 45 25 00	1. NOT USED.
34 45 26 00	1. NOT USED.
34 45 27 00	1. NOT USED.
34 45 28 00	1. NOT USED.
34 45 29 00	1. Aural glideslope warning when on glide path below 1000 feet radio altitude. 2. 34-45-00 Fig. 105 Block 1 34-45-00 Fig. 107 Block 1
34 45 30 00	1. Aural glideslope warning without LOC frequency selected. 2. 34-45-00 Fig. 105 Block 1 34-45-00 Fig. 107 Block 1
34 45 31 00	1. Aural glideslope warning during back-course approach. 2. 34-45-00 Fig. 107 Block 5
34 45 32 00	1. Aural glideslope warning cannot be inhibited by pressing PULL-UP switchlight. 2. 34-45-00 Fig. 107 Block 8

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 45 33 00	1. PULL-UP light on, no aural warning. 2. 34-45-00 Fig. 108 Block 1
34 45 34 00	1. PULL-UP warning during normal descent, No. 1 LRRA flag in view. 2. 34-45-00 Fig. 105 Block 1
34 45 35 00	1. PULL-UP warning during normal descent, F/O altimeter flag in view. 2. 34-45-00 Fig. 105 Block 1
34 45 36 00	1. PULL-UP warning above 500 feet radio altitude during normal descent, no flags. 2. 34-45-00 Fig. 105 Block 1
34 45 37 00	1. PULL-UP warning below 500 feet radio altitude during normal descent, no flags. 2. 34-45-00 Fig. 105 Block 1
34 45 38 00	1. PULL-UP warning below 500 feet radio altitude during take-off, no flags in view. 2. 34-45-00 Fig. 105 Block 1
34 45 39 00	1. NOT USED.
34 45 40 00	1. PULL-UP light on with aural warning during taxi. 2. 34-45-00 Fig. 106 Block 1
34 45 41 00	1. GPWS MONITOR light ON, on ground. 2. 34-45-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 45 42 00	1. GPWS MONITOR light ON, OFF flag in F/O altimeter.
	2. 34-45-00 Fig. 103 Block 1
34 45 43 00	1. GPWS MONITOR light ON, flag in No. 1 LRRA indicator.
	2. 34-45-00 Fig. 103 Block 1
34 45 44 00	1. GPWS light ON and no flags in view.
	2. 34-45-00 Fig. 103 Block 1
34 45 45 00	1. GPWS will not test, No. 1 LRRA flag in view.
	2. 34-45-00 Fig. 104 Block 1
34 45 46 00	1. GPWS will not test, F/Os altimeter OFF flag in view.
	2. 34-45-00 Fig. 104 Block 1
34 45 47 __	1. (01=CAPT, 02=F/O) GPWS will not test from PULL-UP switchlights, no flags.
	2. 34-45-00 Fig. 104 Block 1
34 45 48 __	1. GPWS will not test, GPWS MONITOR light ON when PULL-UP switchlight pressed. (00=Not Apply)
	2. 34-45-00 Fig. 104 Block 9
34 45 49 00	1. No aural warning when PULL-UP switchlight pressed.
	2. 34-45-00 Fig. 104 Block 1 34-45-00 Fig. 108 Block 1
34 51 01 00	1. F/O DME-1 disagrees with Capt DME-1 readout.
	2. 34-51-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 02 00	1. F/O DME-1 fail flag in view, Capt DME-1 OK.
	2. 34-51-00 Fig. 104 Block 1
34 51 03 00	1. F/O DME-1 covered by dashed line, Capt DME-1 OK.
	2. 34-51-00 Fig. 104 Block 1
34 51 04 00	1. Both Capt and F/O DME-1 fail flags in view.
	2. 34-51-00 Fig. 104 Block 1
34 51 05 00	1. Capt DME-1 fail flag in view, F/O DME-1 OK.
	2. 34-51-00 Fig. 104 Block 1
34 51 06 00	1. Capt and F/O DME-1 show dashed line.
	2. 34-51-00 Fig. 104 Block 1
34 51 07 00	1. Capt DME-1 shows dashed line, F/O DME-1 OK.
	2. 34-51-00 Fig. 104 Block 1
34 51 08 00	1. DME-1 weak, unreliable, limited range lock-on (both indicators).
	2. 34-51-00 Fig. 103 Block 1
34 51 09 00	1. NOT USED.
34 51 10 00	1. Capt and F/O DME-1 cycle, loss of lock-on.
	2. 34-51-00 Fig. 104 Block 1
34 51 11 00	1. Capt and F/O DME-1 fail flags in view, DME audio OK.
	2. 34-51-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 12 __	1. (01=CAPT, 02=F/O, 03=BOTH) DME-1 readout erratic, sometimes skips.
	2. 34-51-00 Fig. 105 Block 2
34 51 13 00	1. Capt readout frozen, no fail flag or dashed line shutter showing. F/O DME OK.
	2. 34-51-00 Fig. 105 Block 3
34 51 14 00	1. Captain DME-1 frozen, no fail flag or dashed line shutter is showing. F/O DME identical.
	2. 34-51-00 Fig. 105 Block 4
34 51 15 00	1. NOT USED.
34 51 16 00	1. Capt and F/O DME-1 fail flags in view, no DME audio present.
	2. 34-51-00 Fig. 104 Block 1
34 51 17 00	1. Capt and F/O DME-1 covered by dashed line, station identification audio disagrees with frequency selected.
	2. 34-51-00 Fig. 104 Block 1
34 51 18 00	1. Capt DME self-test inoperative.
	2. 34-51-00 Fig. 103 Block 1
34 51 19 00	1. Capt DME-2 disagrees with F/O DME-2.
	2. 34-51-00 Fig. 103 Block 1
34 51 20 00	1. Capt DME-2 fail flag in view, F/O DME-2 OK.
	2. 34-51-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 21 00	1. Capt DME-2 covered by dashed line, F/O DME-2 OK. 2. 34-51-00 Fig. 104 Block 1
34 51 22 00	1. Capt and F/O DME-2 fail flags in view. 2. 34-51-00 Fig. 104 Block 1
34 51 23 00	1. F/O DME-2 fail flag in view, Capt DME-2 OK. 2. 34-51-00 Fig. 104 Block 1
34 51 24 00	1. Capt and F/O DME-2 show dashed line. 2. 34-51-00 Fig. 104 Block 1
34 51 25 00	1. F/O DME-2 shows dashed line, Capt DME-2 OK. 2. 34-51-00 Fig. 104 Block 1
34 51 26 00	1. DME-2 weak, unreliable, has limited range lock-on, both indicators. 2. 34-51-00 Fig. 105 Block 1
34 51 27 00	1. F/O DME-2 has abnormal indications or fail flag in view, Capt OK. 2. 34-51-00 Fig. 104 Block 1
34 51 28 00	1. Capt and F/O DME-2 cycles, loss of lock-on. 2. 34-51-00 Fig. 104 Block 1
34 51 29 __	1. (01=CAPT, 02=F/O, 03=BOTH) DME-2 readout erratic, skips. 2. 34-51-00 Fig. 105 Block 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 30 00	1. F/O DME-2 frozen, no fail flag or dashed line shutter showing. Capt DME OK.
	2. 34-51-00 Fig. 105 Block 3
34 51 31 00	1. F/O DME-2 frozen, no fail flag or dashed line shutter showing. Captain DME identical.
	2. 34-51-00 Fig. 105 Block 4
34 51 32 00	1. Capt and F/O DME-2 fail flags in view, DME audio present.
	2. 34-51-00 Fig. 104 Block 1
34 51 33 00	1. Capt and F/O DME-2 fail flags in view, no DME audio present.
	2. 34-51-00 Fig. 104 Block 1
34 51 34 00	1. Capt and F/O DME-2 OK, no DME audio present.
	2. 34-51-00 Fig. 104 Block 1
34 51 35 00	1. Capt and F/O DME-2 covered by dashed line, station identification audio disagrees with frequency selected.
	2. 34-51-00 Fig. 104 Block 1
34 51 36 00	1. F/O DME self-test inoperative.
	2. 34-51-00 Fig. 103 Block 1
34 51 37 00	1. F/O DME OVRD mode inoperative, will not lock-on past 200 miles.
	2. 34-51-00 Fig. 104 Block 1
34 51 38 00	1. NOT USED.
34 51 39 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 51 40 00	1. CAPT DME-1 abnormal indication or fail flag in view, F/O OK.
	2. 34-51-00 Fig. 104 Block 1
34 51 41 00	1. Capt DME OVRD mode inoperative, will not lock-on past 200-miles.
	2. 34-51-00 Fig. 104 Block 1
34 51 42 00	1. Capt and F/O RDDMI ok, no DME audio present.
	2. 34-51-00 Fig. 104 Block 1
34 53 01 __	1. (11=SYS-1, 12=SYS-2) control panel FAULT light on.
	2. 34-53-00 Fig. 103 Block 1
34 53 02 __	1. Ground control reports, no altitude reporting with (11=SYS 1, 12=SYS 2) selected.
	2. 34-53-00 Fig. 105 Block 1
34 53 03 __	1. Ground control reports altitude reporting too high or low with (11=SYS 1, 12=SYS 2) selected.
	2. 34-53-00 Fig. 105 Block 1
34 53 04 __	1. Ground control reports, no reply received with (11=SYS 1, 12=SYS 2) selected.
	2. 34-53-00 Fig. 103 Block 1 34-53-00 Fig. 104 (Sheet 1) Block 1 34-53-00 Fig. 104 (Sheet 2) Block 1
34 53 05 __	1. Ground control reports, no identification received with (11=SYS 1, 12=SYS 2) selected.
	2. 34-53-00 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 53 06 __	1. Ground control reports, ATC weak with (11=SYS 1, 12=SYS 2) selected. 2. 34-53-00 Fig. 103 Block 1 34-53-00 Fig. 104 (Sheet 1) Block 1 34-53-00 Fig. 104 (Sheet 2) Block 1
34 55 01 __	1. (01=CAPT, 02=F/O) HSI NAV flag in view. Other VOR indications normal. 2. 34-55-00 Fig. 107 (Sheet 4) Block 1
34 55 02 __	1. (01=CAPT, 02=F/O) "FROM" not in view passing over VOR station. 2. 34-55-00 Fig. 107 (Sheet 1) Block 1
34 55 03 __	1. (01=CAPT, 02=F/O) "TO" not in view flying toward VOR station. 2. 34-55-00 Fig. 107 (Sheet 1) Block 2
34 55 04 __	1. (01=CAPT, 02=F/O) VOR failed, no HSI NAV flag in view. 2. 34-55-00 Fig. 107 (Sheet 1) Block 3
34 55 05 __	1. (01=CAPT, 02=F/O) course deviation bar not centered when on selected course. 2. 34-55-00 Fig. 107 (Sheet 2) Block 4
34 55 06 __	1. Intermittent (01=CAPT, 02=F/O) HSI NAV flag, system OK. 2. 34-55-00 Fig. 107 (Sheet 2) Block 5
34 55 07 __	1. (01=CAPT, 02=F/O) glideslope scale in view with VOR selected. 2. 34-55-00 Fig. 107 (Sheet 2) Block 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 55 08 __	1. (01=CAPT, 02=F/O) glideslope bar intermittently in view.
	2. 34-55-00 Fig. 107 (Sheet 2) Block 7
34 55 09 __	1. (17=VOR-1, 18=VOR-2) intermittent/weak, accompanied with intermittent flags, audio may be faulty.
	2. 34-55-00 Fig. 107 (Sheet 2) Block 1 and/or 2
34 55 10 __	1. (17=VOR-1, 18=VOR-2) bearing pointers do not indicate bearing. Other VOR indications normal. Audio may be faulty.
	2. 34-55-00 Fig. 107 (Sheet 1) Block 4
34 55 11 __	1. (17=VOR-1, 18=VOR-2) pointer does not indicate bearing. Audio may be faulty.
	2. 34-55-00 Fig. 107 (Sheet 1) Block 5
34 55 12 __	1. (17=VOR-1, 18=VOR-2) flag and HSI NAV flag in view. Audio may be faulty.
	2. 34-55-00 Fig. 107 (Sheet 4) Block 3
34 55 13 __	1. No RDDMI or HSI flags in view, VOR audio may be missing.
	2. 34-55-00 Fig. 105 Block 1
34 55 14 __	1. (17=VOR-1, 18=VOR-2) bearing pointer(s) hang(s) up at times.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 1
34 55 15 __	1. (01=CAPT, 02=F/O) RDDMI bearing pointers have excessive difference with both VORs tuned to same frequency.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 55 16 __	1. (O1=CAPT, O2=F/O) VHF NAV tuning selects incorrect VOR station.
	2. 34-55-00 Fig. 105 Block 2
34 55 17 __	1. (O1=CAPT, O2=F/O) VOR and DME station identification disagrees with selected frequency.
	2. 34-55-00 Fig. 105 Block 2
34 55 18 __	1. (O1=CAPT, O2=F/O) VOR and DME station identification disagree.
	2. 34-55-00 Fig. 105 Block 2
34 55 19 __	1. (O1=CAPT, O2=F/O) HSI VOR annunciator not in view. Other VOR indications normal.
	2. 34-55-00 Fig. 107 (Sheet 4) Block 2
34 55 20 __	1. (O1=CAPT, O2=F/O) ALTN DEV selected, HSI switches, system annunciator does not change.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 7
34 55 21 __	1. (O1=CAPT, O2=F/O) Cruise monitor light on, VOR frequency selected.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 8
34 55 22 00	1. NOT USED.
34 55 23 __	1. Both VORs tuned to same frequency, RDDMI VOR pointers OK, course set selectors on NAV MODE panel are set out of tolerance (in regard to each other) to center (O1=CAPT, O2=F/O) HSI course deviation bar.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 55 24 __	1. Both VORs tuned to same frequency, (O1=CAPT, O2=F/O) HSI course deviation bars disagree.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 4
34 55 25 __	1. Both VORs tuned to same frequency, (O1=CAPT, O2=F/O) RDDMI VOR pointer too far left or right of HSI course deviation bar when centered. Capt and F/O HSI course deviation bars agree.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 5
34 55 26 __	1. Both VORs tuned to same frequency, (O1=CAPT, O2=F/O) RDDMI VOR pointer too far left or right of HSI course deviation bar when centered. Capt and F/O HSI course deviation bars disagree.
	2. 34-55-00 Fig. 107 (Sheet 3) Block 6
34 55 27 __	1. (O1=CAPT, O2=F/O) HSI COURSE indications do not follow COURSE set control on NAV MODE panel.
	2. 34-55-00 Fig. 106 Block 2
34 57 01 00	1. ADF mode; F/O RDDMI pointer wanders, Capt RDDMI pointer and audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 1
34 57 02 00	1. ADF mode; F/O RDDMI pointer disagrees with Capt RDDMI pointer.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 2
34 57 03 00	1. ADF mode; F/O RDDMI pointer inoperative or sticks, Capt RDDMI pointer and audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 2
34 57 04 00	1. ADF mode; both Capt and F/O RDDMI pointer wander, audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 57 05 00	1. ADF mode; Capt RDDMI pointer wanders, F/O RDDMI pointer and audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 1
34 57 06 00	1. ADF mode; Capt RDDMI pointer disagrees with F/O RDDMI pointer, audio OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 2
34 57 07 00	1. ADF mode; both Capt and F/O RDDMI pointers inoperative or sticks, audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 2
34 57 08 00	1. ADF mode; Capt RDDMI pointer inoperative or sticks, F/O RDDMI pointer and audio OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 2
34 57 09 00	1. ADF mode; Capt and F/O RDDMI pointers indicate excessive error from known bearing.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 1
34 57 10 00	1. ADF mode; Capt RDDMI pointer indicates excessive error from known bearing, F/O RDDMI pointer OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 1
34 57 11 00	1. ADF mode; no audio, Capt and F/O RDDMI pointers agree and point to known relative bearing of station tuned.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3
34 57 12 00	1. ADF mode; no audio, Capt and F/O RDDMI pointers wander.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 57 13 00	1. ADF mode, no audio, Capt and F/O RDDMI pointers inoperative, or in error.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3
34 57 14 00	1. ADF mode; no audio, Capt RDDMI pointer inoperative, or in error. F/O RDDMI pointer OK.
	2. 34-57-00 Fig. 104 (Sheet 1) Block 2
34 57 15 00	1. Will not tune one, or all, frequency ranges.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 6
34 57 16 00	1. No BFO, all else OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 4
34 57 17 00	1. ADF mode; Capt and F/O RDDMI pointer 180-degrees out from known relative bearing to tuned station, audio OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 1
34 57 18 00	1. ADF mode; Capt RDDMI pointer 180-degrees out from known relative bearing to tuned station, F/O RDDMI pointer and audio OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 1
34 57 19 00	1. Frequency readout on control panel disagrees with frequency of station tuned.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 5
34 57 20 00	1. NOT USED.
34 57 21 00	1. ANT mode; no audio, Capt and F/O RDDMI pointers stowed.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
34 57 22 00	1. ANT mode; no audio, Capt and F/O RDDMI pointers wander.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3
34 57 23 00	1. No audio - any mode, Capt and F/O RDDMI pointers OK.
	2. 34-57-00 Fig. 104 (Sheet 2) Block 3

CHAPTER 34
NAVIGATION - DESCRIPTION AND OPERATION

1. General

The navigation system consists of the equipment used to sense, determine, process and display navigation information. Navigation information is the data used to determine the position, heading, and attitude of the aircraft with respect to the earths surface. This data is obtained from the air data system, the heading and attitude systems, radio, radar, ground proximity, and associated instrument displays. The systems are grouped as follows:

Flight environment: pitot-static and air temperature systems, air data computer system, central instrument
R warning system, standby altitude airspeed instruments, and
R (on aircraft with SB34-179) windshear warning and guidance system.

Attitude and direction: vertical gyros/inertial navigation units, attitude indicators, standby attitude indicator, magnetic compass, and standby compass.

Landing aids: radio altimeter, instrument landing and marker beacon systems.

Independent position determining: inertial navigation on certain aircraft, ground proximity warning, and weather radar.

Dependent position determining: distance measuring equipment, ATC transponder, VOR, and ADF systems.

The navigation equipment (Ref. Fig. 1) is located in the forward electronics service center and radome, zones 111, 112, and 113; the mid electrical service center, zone 137; and the flight station, zone 210. All antennas (Ref. Fig. 2) are mounted to the exterior surfaces of the aircraft except the weather radar and ILS antennas, which are inside the nose radome.

Instrument Source Selection: the instrument source selector system consists of two INSTRUMENT SOURCE SELECT panels. One panel is located on the Captains instrument panel, zone 211, and the other is located on the First Officers instrument panel, zone 212. Each panel contains seven switchlights which provide the Captain and First Officer with alternate switching capabilities (Ref. Fig. 3).

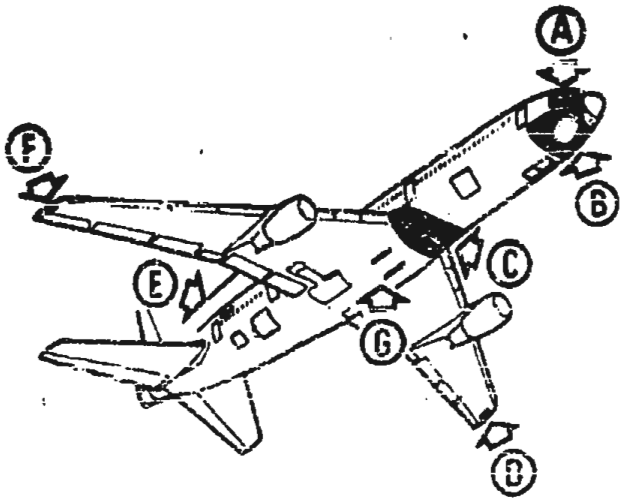
28V dc is supplied for use within the Instrument Source Select panels from the DC essential bus.

When a switchlight is depressed, it lights and energizes one or more relays in the indicators or accessory units. If the switchlight is depressed a second time, the light will go out and the relays will deenergize (Ref. Fig. 4).

Instruments are grouped with the system providing their primary display, but several instruments have multiple information displays provided by different systems. These are: attitude director indicator (ADI), horizontal situation indicator (HSI), and radio digital distance magnetic indicator (RDDMI).

Figure 5 is the ADI home diagram. The diagram indicates the ATA reference of the system that controls the indicated function.

The circuit breakers controlling the power supplied to the navigation systems are located on the pilots overhead circuit breaker panel CB1.



(A)

FLIGHT STATION

ZONE 210

INSTRUMENT SOURCE SELECT PANEL (34-00-01)
STANDBY PNEUMATIC AIRSPEED INDICATOR (34-13-00)
STANDBY BAROMETRIC ALTITUDE INDICATOR (34-13-00)
BAROMETRIC ALTITUDE INDICATOR (34-14-00)
AIRSPEED MACH INDICATOR (34-14-00)
VERTICAL SPEED INDICATOR (34-14-00)
TRUE AIRSPEED INDICATOR (34-14-00)
STATIC AIR TEMPERATURE INDICATOR (34-15-00)
TAT/RATED EPR INDICATOR (77-13-00)
INSTRUMENT COMPARISON DISPLAY PANEL (34-16-00)
ATTITUDE DIRECTOR INDICATOR (34-21-00)
COMPASS CONTROLLER (34-22-00)
STANDBY MAGNETIC COMPASS (34-22-00)
STANDBY HORIZON INDICATOR (34-23-00)
RADIO ALTITUDE INDICATOR (34-32-00)
MARKER BEACON LIGHT ASSEMBLY (34-35-00)
WEATHER RADAR DUAL CONTROL PANEL (34-44-00)
WEATHER RADAR INDICATOR (34-44-00)
ATC CONTROL PANEL (34-53-00)
VHF NAVIGATION CONTROL PANEL (34-55-00)
HORIZONTAL SITUATION INDICATOR (34-55-00)
ADF CONTROL PANEL (34-57-00)
RADIO DIGITAL DISTANCE MAGNETIC INDICATOR (34-57-00)
CONTROL DISPLAY UNIT (34-43-00) 1
TERRAIN WARNING PANEL (34-45-00)
TERRAIN WARNING LIGHTS (34-45-00)
MODE SELECTOR UNIT (34-43-00) 1
RADIO/INS SWITCH (34-43-00) 1

(B)

FORWARD ELECTRONIC SERVICE CENTER

ZONES 112 AND 113

AIR DATA COMPUTER (34-14-00)
INSTRUMENT COMPARISON MONITOR (34-16-00)
VERTICAL GYRO (34-21-00)
MAGNETIC COMPENSATOR (34-22-00)
COMPASS COUPLER (34-22-00)
DIRECTIONAL GYRO (34-22-00)
HEADING COUPLER ACCESSORY UNIT (34-22-00)
ILS RECEIVER (34-33-00)
MARKER BEACON RECEIVER (34-35-00)
WEATHER RADAR - RECEIVER/TRANSMITTER (34-44-00)
DME INTERROGATOR (34-51-00)
ATC TRANSPONDER (34-53-00)
GPWS FLIGHT PROFILE COMPARATOR (34-45-00)
VOR RECEIVER (34-55-00)
VHF NAVIGATION ACCESSORY UNIT (34-55-00)
INERTIAL NAVIGATION UNIT (34-43-00) 1
INERTIAL BATTERY UNIT (34-43-00) 1
WINDSHEAR ACCESSORY UNIT (34-19-00) 2
WINDSHEAR COMPUTER (34-19-00) 2

(C)

MID ELECTRICAL SERVICE CENTER

ZONE 137

RADIO ALTIMETER RECEIVER/TRANSMITTER (34-32-00)
ADF RECEIVER (34-57-00)

(D)

FLUX VALVE (34-22-00), ZONE 535

(E)

VOR DUAL PREAMPLIFIER (34-55-00), ZONE 274

(F)

FLUX VALVE (34-22-00), ZONE 635

(G)

ADF SENSE ANTENNA COUPLER (34-57-00), ZONE 143

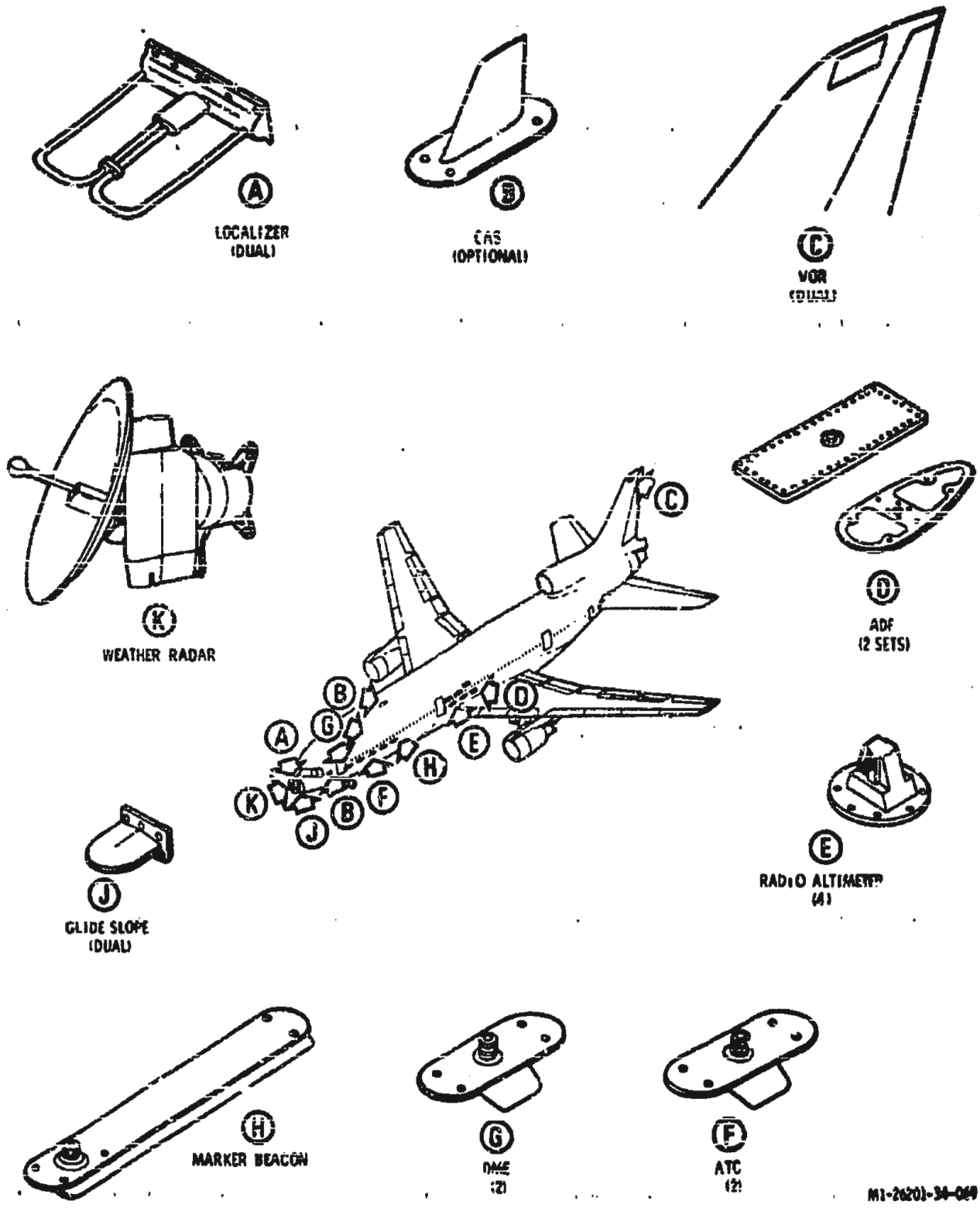
NOTE

1 AIRCRAFT WITH INERTIALS INSTALLED

2 AIRCRAFT WITH SB34-379

M1-0007-34-159

R Navigation Equipment Component Locations
R Figure 1



R Navigation System Antenna Location Diagram
R Figure 2

NOTE

(1) ARS - ATTITUDE REFERENCE SYSTEM

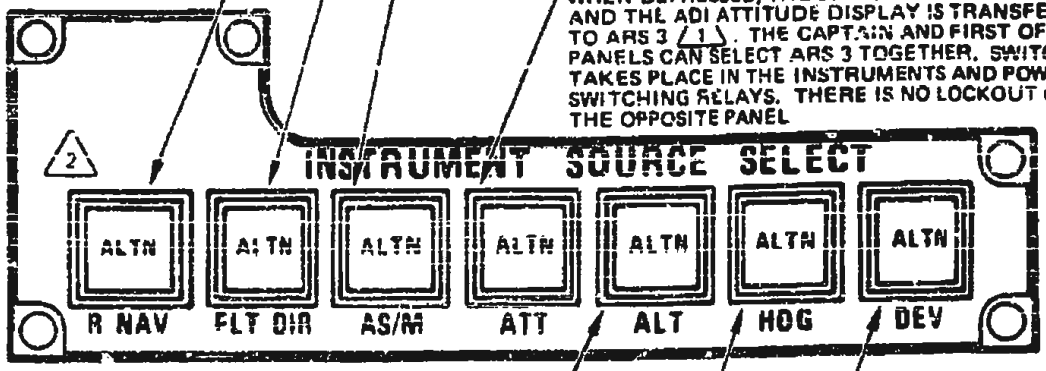
(2) AIRCRAFT WITH INS. NOT CONNECTED ON AIRCRAFT WITHOUT INS

WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE HSI R NAV (INS) NAVIGATION DISPLAY IS TRANSFERRED TO THE OPPOSITE HSI R NAV (INS) NAVIGATION DISPLAY. THE OPPOSITE PANEL IS LOCKED OUT. SWITCHING TAKES PLACE IN THE R NAV (INS) ACCESSORY UNIT.

WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE ADI COMMAND BARS ARE TRANSFERRED TO THE OPPOSITE APPDS ROLL AND PITCH COMPUTERS. THERE IS NO LOCKOUT OF THE OPPOSITE PANEL. SWITCHING TAKES PLACE IN THE HEADING COUPLER ACCESSORY UNIT

WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE AS/MACH INDICATOR IS BOOTSTRAPPED TO THE OPPOSITE INDICATOR WHICH IS BEING DRIVEN BY THE OPPOSITE ADC (ALL 3 INDICATIONS AS, MACH AND Vmo). THE OPPOSITE PANEL IS LOCKED OUT. SWITCHING TAKES PLACE IN THE INSTRUMENTS. THE LOCKOUT RELAY IS IN THE SELECT PANEL

WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE ADI ATTITUDE DISPLAY IS TRANSFERRED TO ARS 3 (1). THE CAPTAIN AND FIRST OFFICER PANELS CAN SELECT ARS 3 TOGETHER. SWITCHING TAKES PLACE IN THE INSTRUMENTS AND POWER SWITCHING RELAYS. THERE IS NO LOCKOUT OF THE OPPOSITE PANEL



WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE ALTITUDE INDICATOR IS BOOTSTRAPPED TO THE OPPOSITE INDICATOR WHICH IS BEING DRIVEN BY THE OPPOSITE ADC. THE VSI IS BOOTSTRAPPED TO THE OPPOSITE VSI AND IS TRANSFERRED WITH THE ALTIMETER. THE OPPOSITE PANEL IS LOCKED OUT. THE LOCKOUT RELAY IS LOCATED IN THE SELECT PANEL. SWITCHING TAKES PLACE IN THE INSTRUMENTS

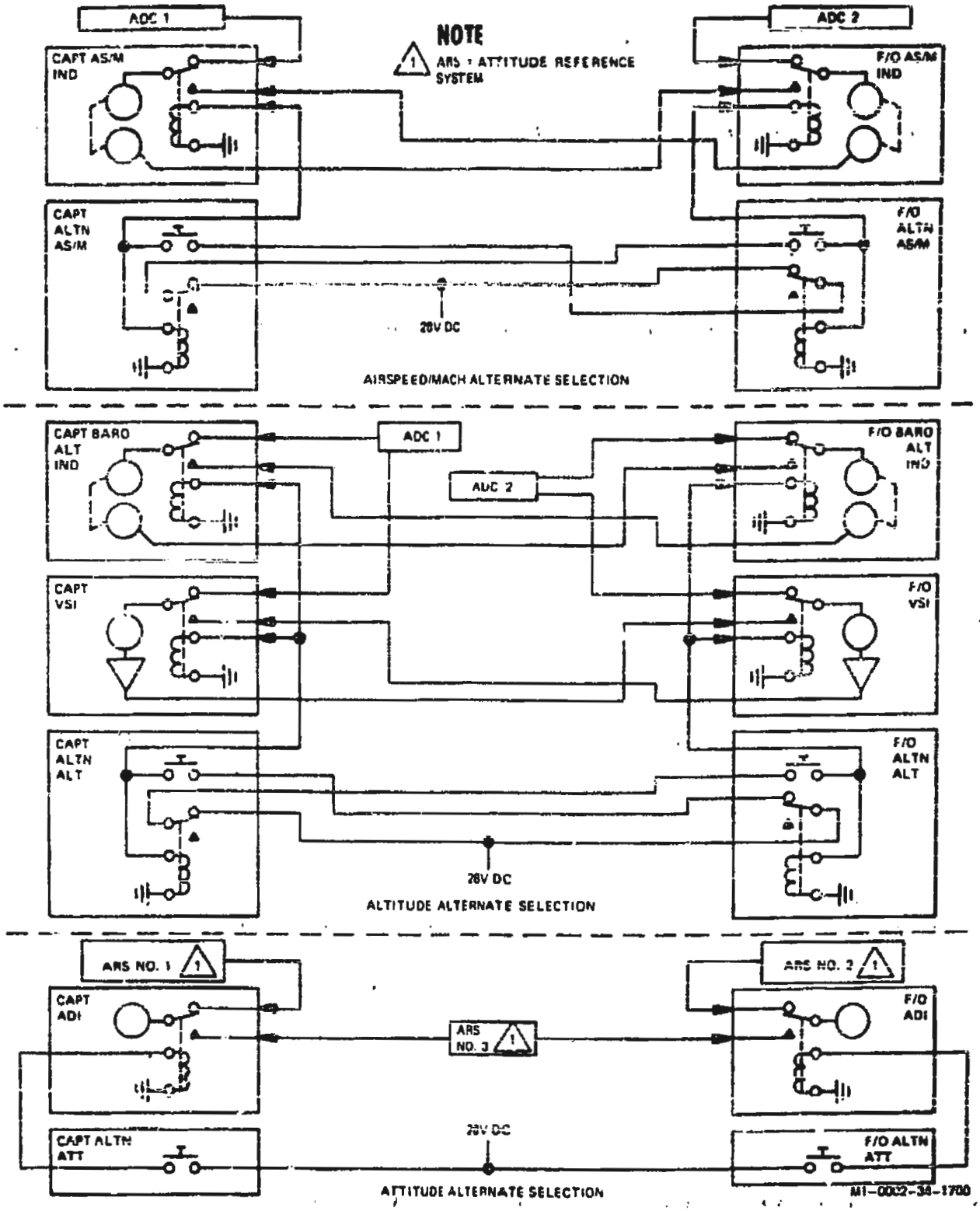
WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND THE HSI COMPASS CARD TRANSFERS TO THE OPPOSITE COMPASS SYSTEM. THE COMPASS CARD IS NOW IN PARALLEL WITH THE HEADING/PITCH MODE AND NAV MODE PANELS. THE RDDMI'S DO NOT SWITCH. SWITCHING TAKES PLACE IN THE HEADING COUPLER ACCESSORY UNIT. THE OPPOSITE PANEL IS LOCKED OUT

WHEN DEPRESSED, THE SWITCHLIGHT ILLUMINATES AND IF VOR IS SELECTED, THE HSI COURSE DEVIATION BAR WILL BE TRANSFERRED TO THE OPPOSITE VOR. IF ILS IS SELECTED, THE HSI COURSE DEVIATION BAR AND HSI GLIDE SLOPE INDICATION WILL BE TRANSFERRED. SWITCHING TAKES PLACE IN THE VHF NAV ACCESSORY UNIT. THE OPPOSITE PANEL IS LOCKED OUT

M1-0002-34-1701

CR
CR

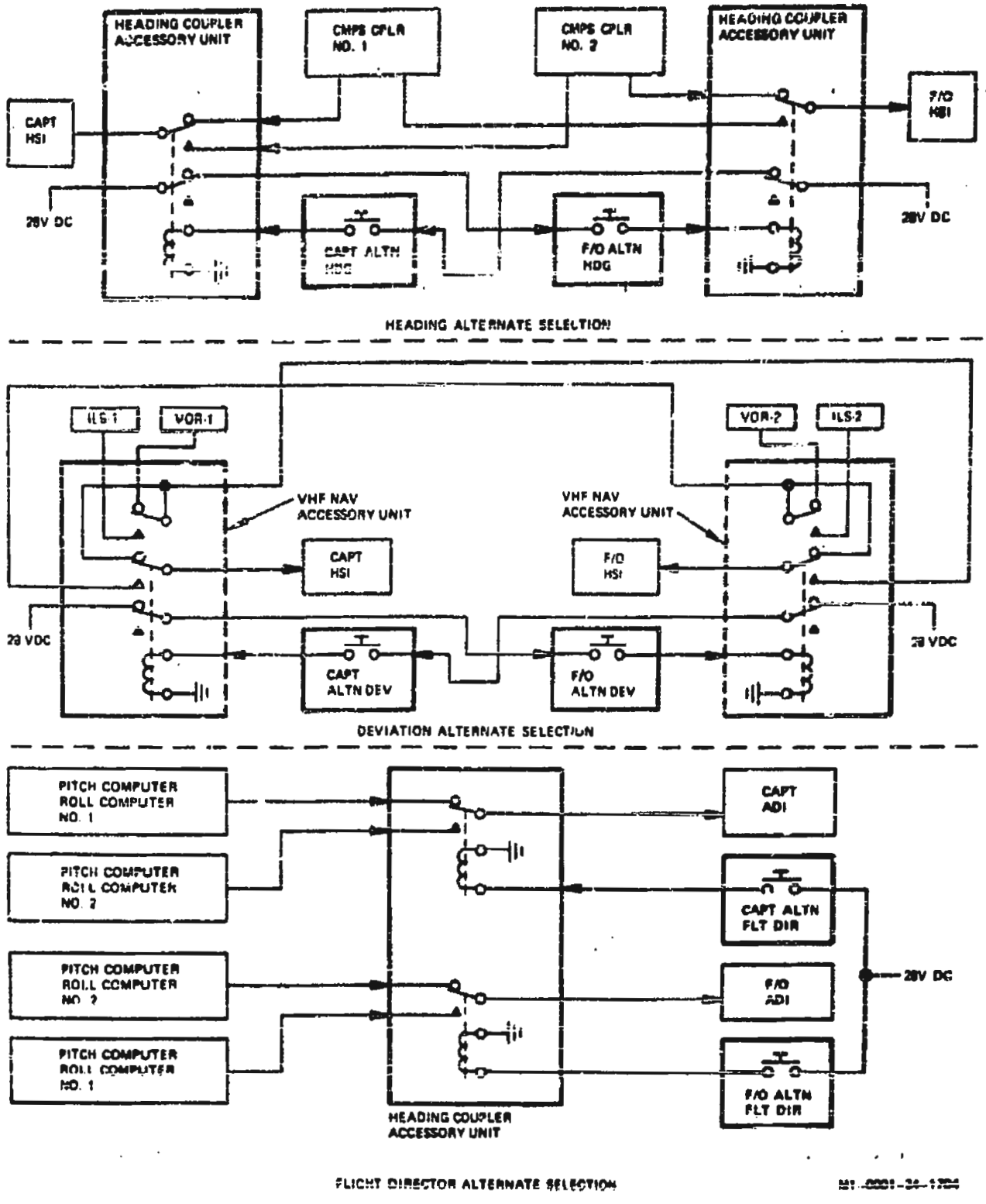
Instrument Source Select Panel
Figure 3



R R Instrument Source Select Block Diagram
Figure 4 (Sheet 1)

EFFECTIVITY: ALL

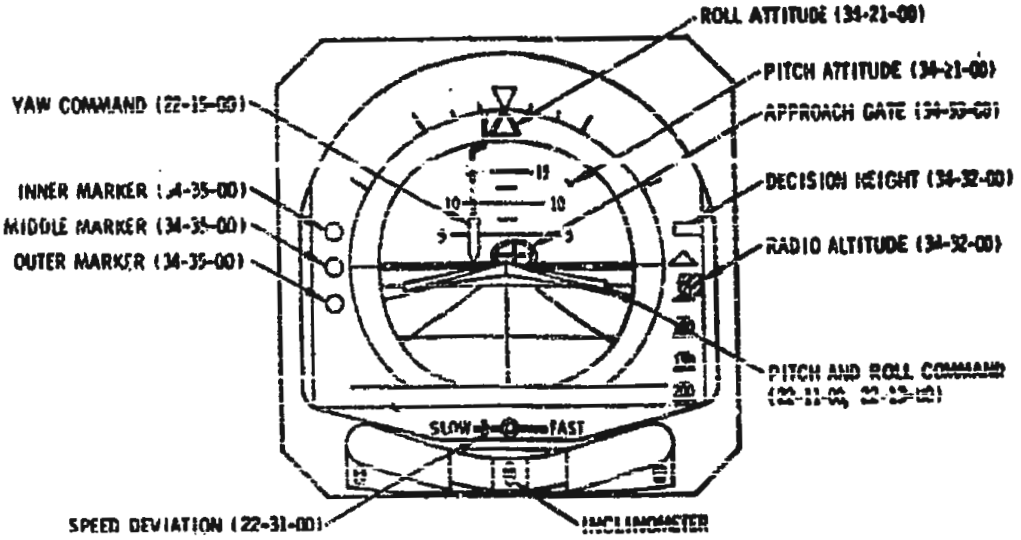
001B

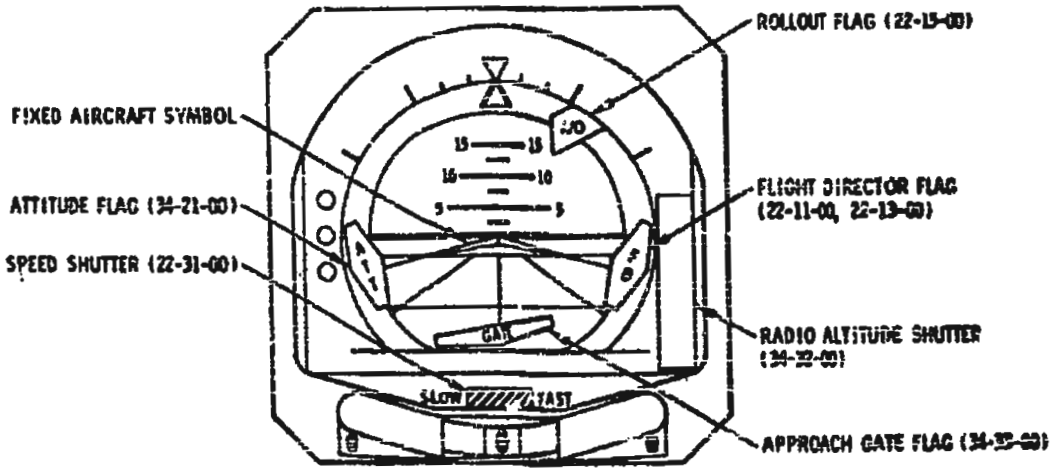


R Instrument Source Select Block Diagram
R Figure 4 (Sheet 2)

EFFECTIVITY: ALL

001B





M1-25301-34-005

Attitude Director Indicator Home Diagram
Figure 5

INSTRUMENT SOURCE SELECTOR PANEL - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on using fault code diagram or schematic.

R If flight crew reports a trouble using a FIRM fault code, the
R code can be found in 34 Fault Code Index. The index specifies
R maintenance manual section, fault isolation diagram, and block
R number on diagram where fault isolation procedure should start.
R Schematics are included at end of section to supplement fault
R isolation diagrams or as aid in isolating a problem not covered
R on diagrams.

R Refer to Maintenance Manual Introduction for a more detailed
R discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
R Cross Reference (WM DIA CROSS REF) table on system functional
R schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

C 2. Referenced Procedures

C	34-14-00	Central Air Data Computer System - Fault Isolation
C	34-21-00	Attitude Reference System - Fault Isolation
C	34-22-00	Magnetic Heading Reference System - Fault Isolation
C	34-43-00	Inertial Navigation System - Fault Isolation
C	34-55-00	VOR System - Fault Isolation

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide Instrument Source Select Panel locations.

Fault Isolation Diagrams and Schematics List
Table 101

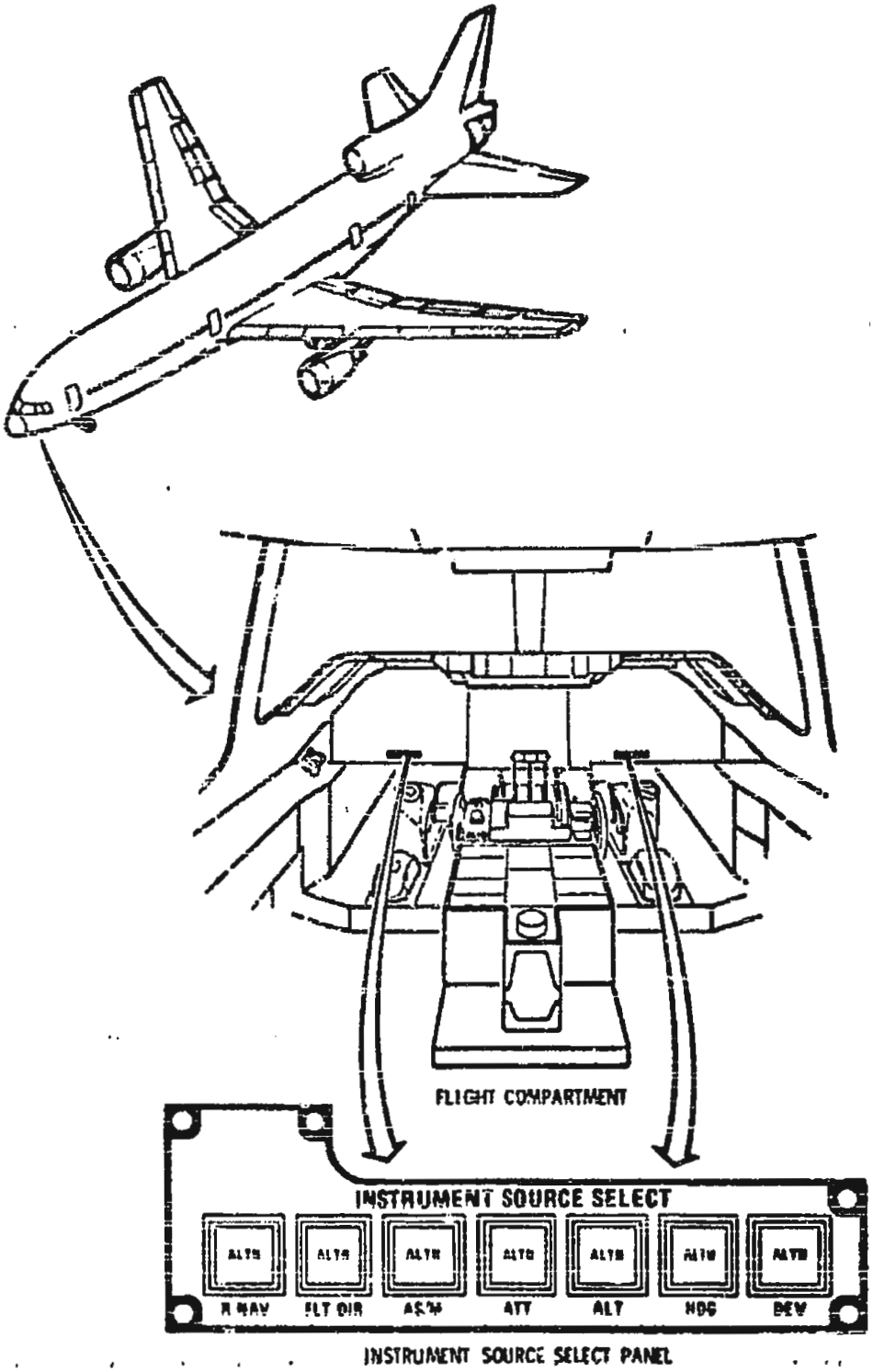
	FIGURE NUMBER	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	ALTN Select Problems
	SCHEM 1	Instrument Source Select Schematic (ALTN AS/M, ALTN ALT)
	SCHEM 2	Instrument Source Select Schematic (ALTN ATT)
	SCHEM 3	Instrument Source Select Schematic (ALTN HDG)
	SCHEM 4	Instrument Source Select Schematic (ALTN FLT DIR)
R	SCHEM 5	Instrument Source Select Schematic (ALTN DEV)
	SCHEM 6	Instrument Source Select Schematic (ALTN RNAV)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
PANEL – INSTRUMENT SOURCE SELECT	2	FLT STA; CAPT AND F/O INSTR PNL	34-0C-01

M1-0000-34-3277

Component Location Index
Figure 101

EFFECTIVITY: ALL



INSTRUMENT SOURCE SELECT PANEL

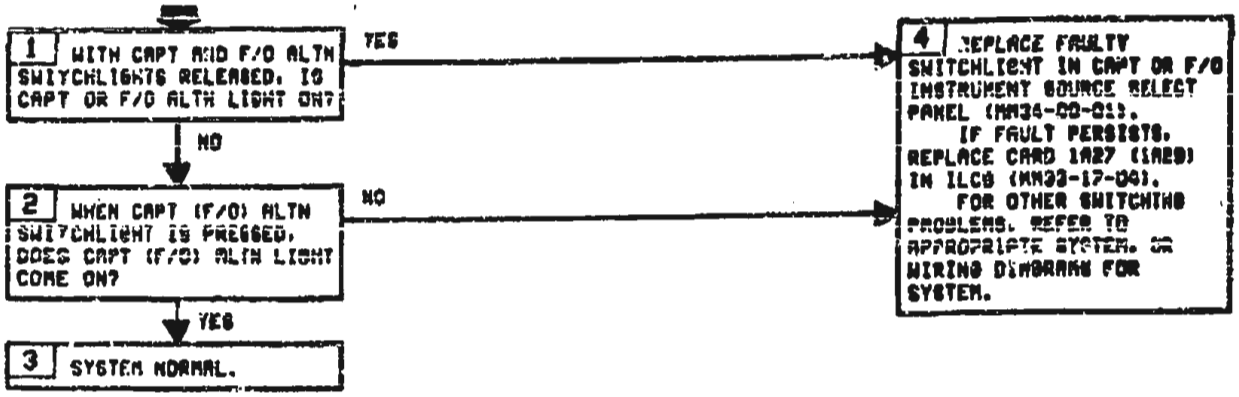
MI-27600-34-2189

R
R Component Locator Diagram
Figure 102

R EFFECTIVITY: ALL
R
0018

PREREQUISITES
ELECTRICAL POWER (AM24-00-00)
CB'S: 1E1, 1E2
BOTH INSTRUMENT SOURCE SELECT PANEL SWITCHLIGHTS RELEASED
PERFORM LIGHTS TEST ON PILOTS OVERHEAD TEST PANEL TO VERIFY
ALTN SWITCHLIGHT COMES ON

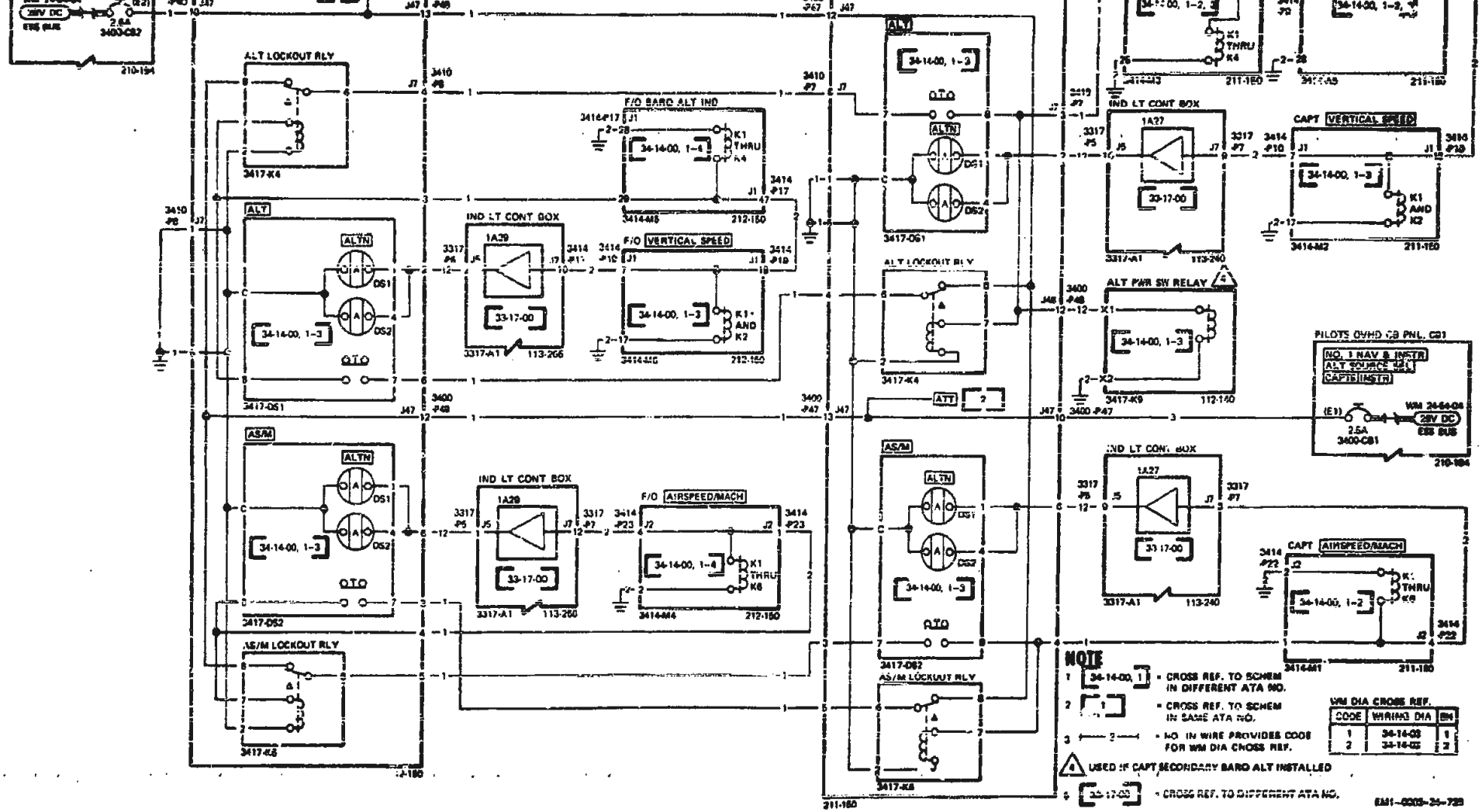
ALTN SELECT PROBLEMS


1 WITH CAPT AND F/O ALTN SWITCHLIGHTS RELEASED, IS CAPT OR F/O ALTN LIGHT ON?
YES
NO
2 WHEN CAPT (F/O) ALTN SWITCHLIGHT IS PRESSED, DOES CAPT (F/O) ALTN LIGHT COME ON?
NO
YES
3 SYSTEM NORMAL.
4 REPLACE FAULTY SWITCHLIGHT IN CAPT OR F/O INSTRUMENT SOURCE SELECT PANEL (AM34-00-01).
IF FAULT PERSISTS, REPLACE CARD 1A27 (1A29) IN ILCB (AM33-17-04).
FOR OTHER SWITCHING PROBLEMS, REFER TO APPROPRIATE SYSTEM WIRING DIAGRAM FOR SYSTEM.

R1-0005-34-1288

R ALTN Select Problems
R Figure 103

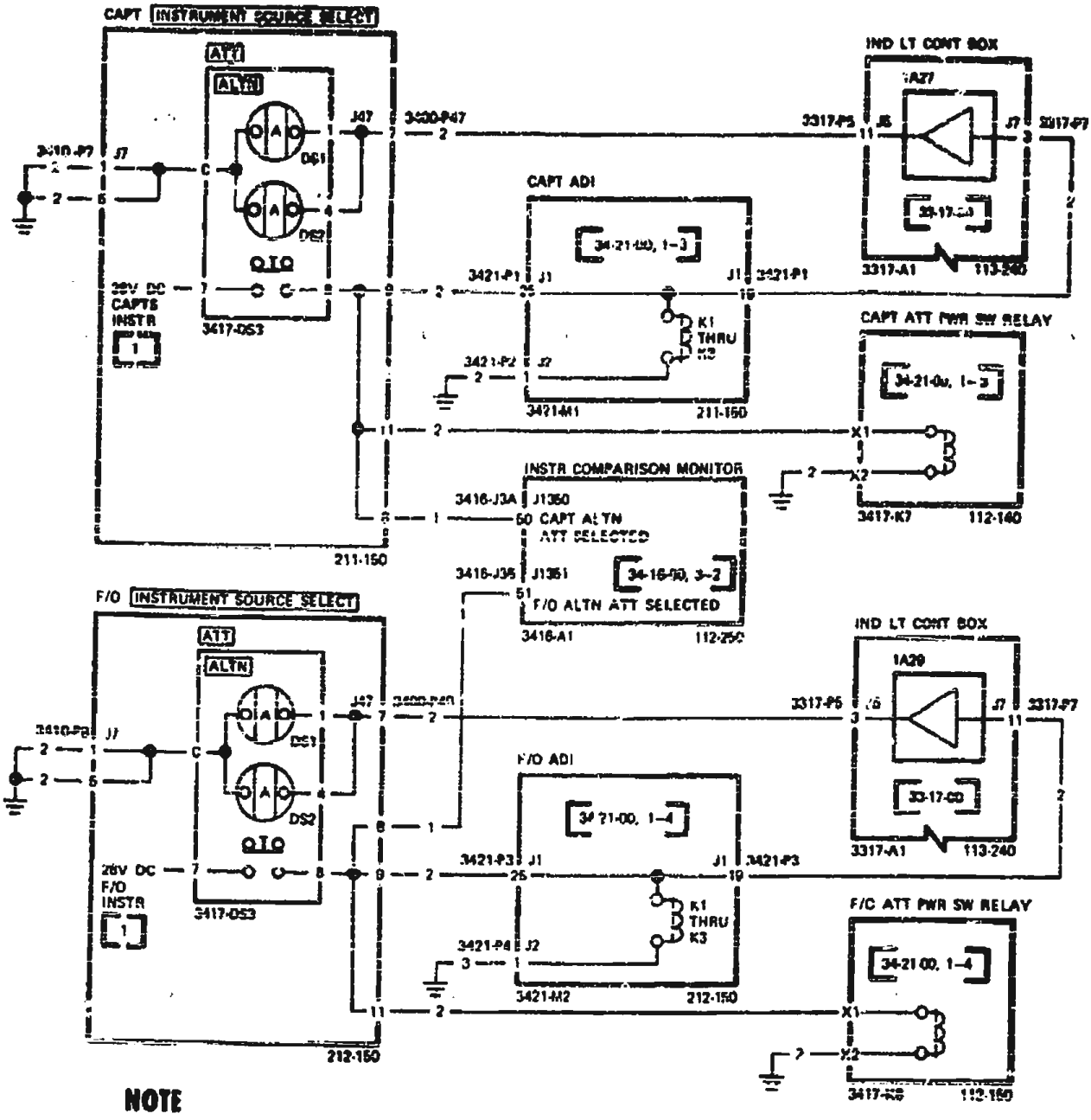
R EFFECTIVITY: ALL
R
0012



R Instrument Source Select Schematic (ALTN AS/M, ALTN ALT)
R SCHEM 1

EFFECTIVITY: ALL

001B



NOTE

1 [34-21-00, 1-1] = CROSS REF. TO SCHEM AND SHEET IN DIFFERENT ATA NO.

2 [33-17-00] = CROSS REF. TO DIFFERENT ATA NO.

3 [ ] = CROSS REF. TO SCHEM IN SAME ATA NO.

4 —2— = NO. IN WIRE PROVIDES CODE FOR WIR DIA CROSS REF.

WIR DIA CROSS REF.

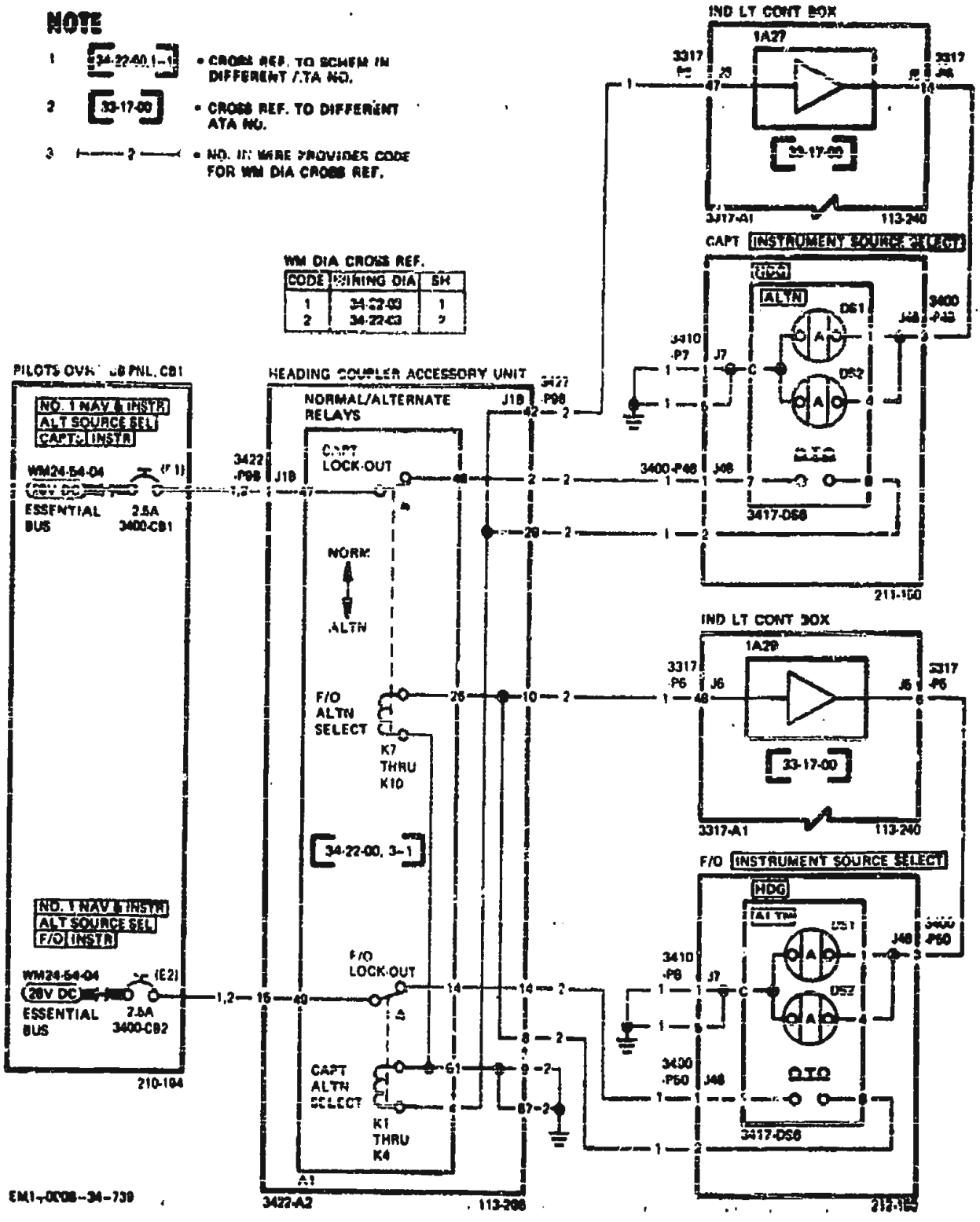
CODE	WIRING DIA	SH
1	34-19-02	1
2	34-21-03	1

EM1-0008-34-732

R Instrument Source Select Schematic (ALTN ATT)
R SCHEM 2

EFFECTIVITY: ALL

001B

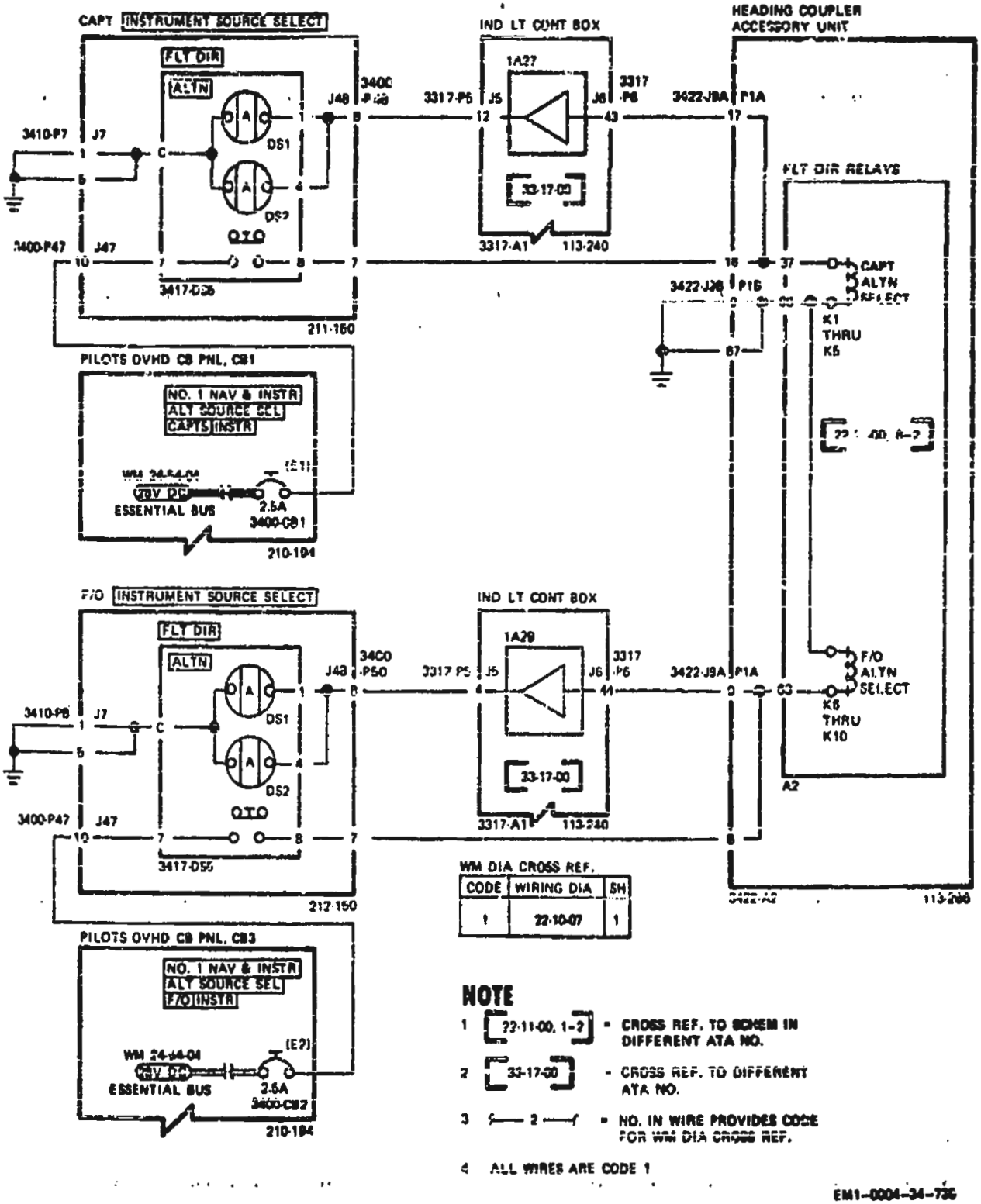


R

Instrument Source Select Schematic (ALTN HDG)
SCHEM 3

EFFECTIVITY: ALL

001B



R Instrument Source Select Schematic (ALTN FLT DIR)
R SCHEM 4

EFFECTIVITY: ALL

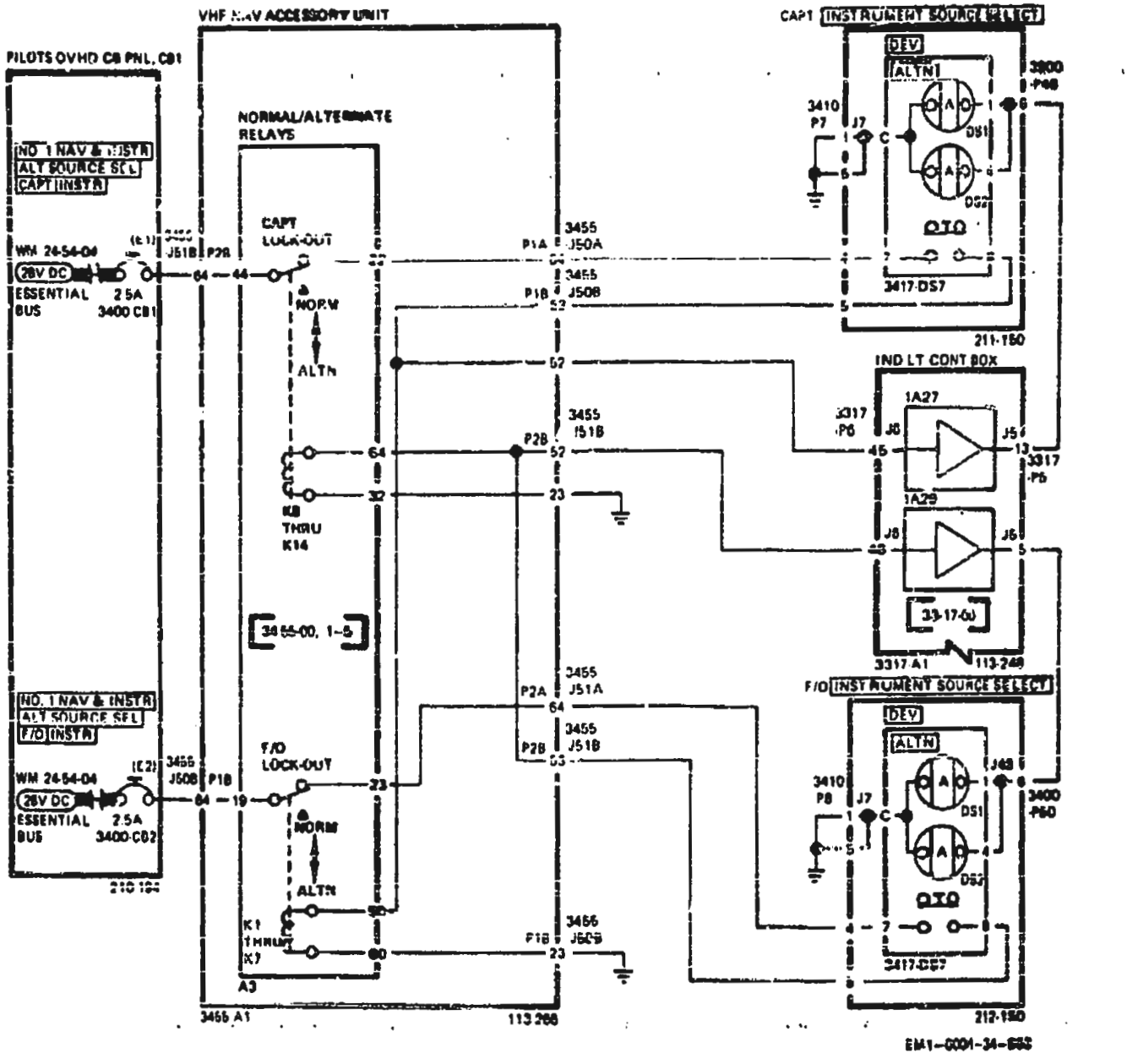
0018

NOTE

1. [34-55-00, 1-1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. [J7-17-00] • CROSS REF. TO DIFFERENT ATA NO.
3. 1 — 2 — 1 • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4. ALL WIRES ARE CODE 1

WM DIA CROSS REF.

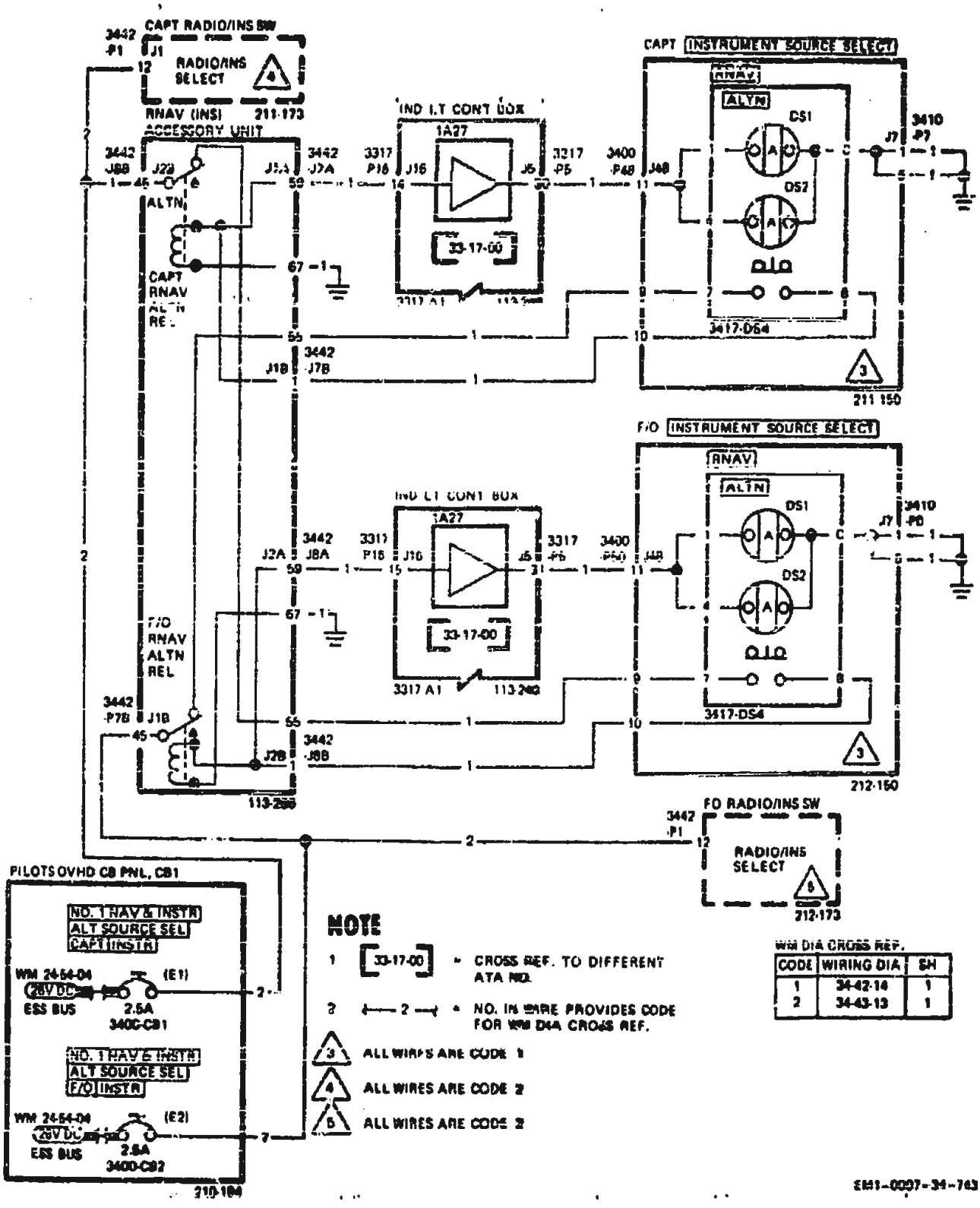
CODE	WIRING DIA	SH
1	34-55-03	1



R Instrument Source Select Schematic (ALTN DEV)
R SCHEM 5

EFFECTIVITY: ALL

001B



CR Instrument Source Select Schematic (RNAV)
CR SCHEM 6

EFFECTIVITY: INS EQUIPPED AIRCRAFT

001B

INSTRUMENT SOURCE SELECT PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-00-01 Instrument Source Select Panel - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers ALT SOURCE SEL - INSTR (E1), INSTR (E2) and 5 VAC INSTRUMENT LIGHTING (L20) and (L25). R R R

(2) Locate INSTRUMENT SOURCE SELECT panel on Captains instrument panel, zone 211, and First Officers instrument panel, zone 212, (Ref. Fig. 401).

(3) Remove bolts securing INSTRUMENT SOURCE SELECT panel to Captains or First Officers instrument panel.

(4) Pull INSTRUMENT SOURCE SELECT panel out of recess in Captains or First Officers instrument panel and disconnect aircraft connectors from receptacles. Remove panel.

B. Installation

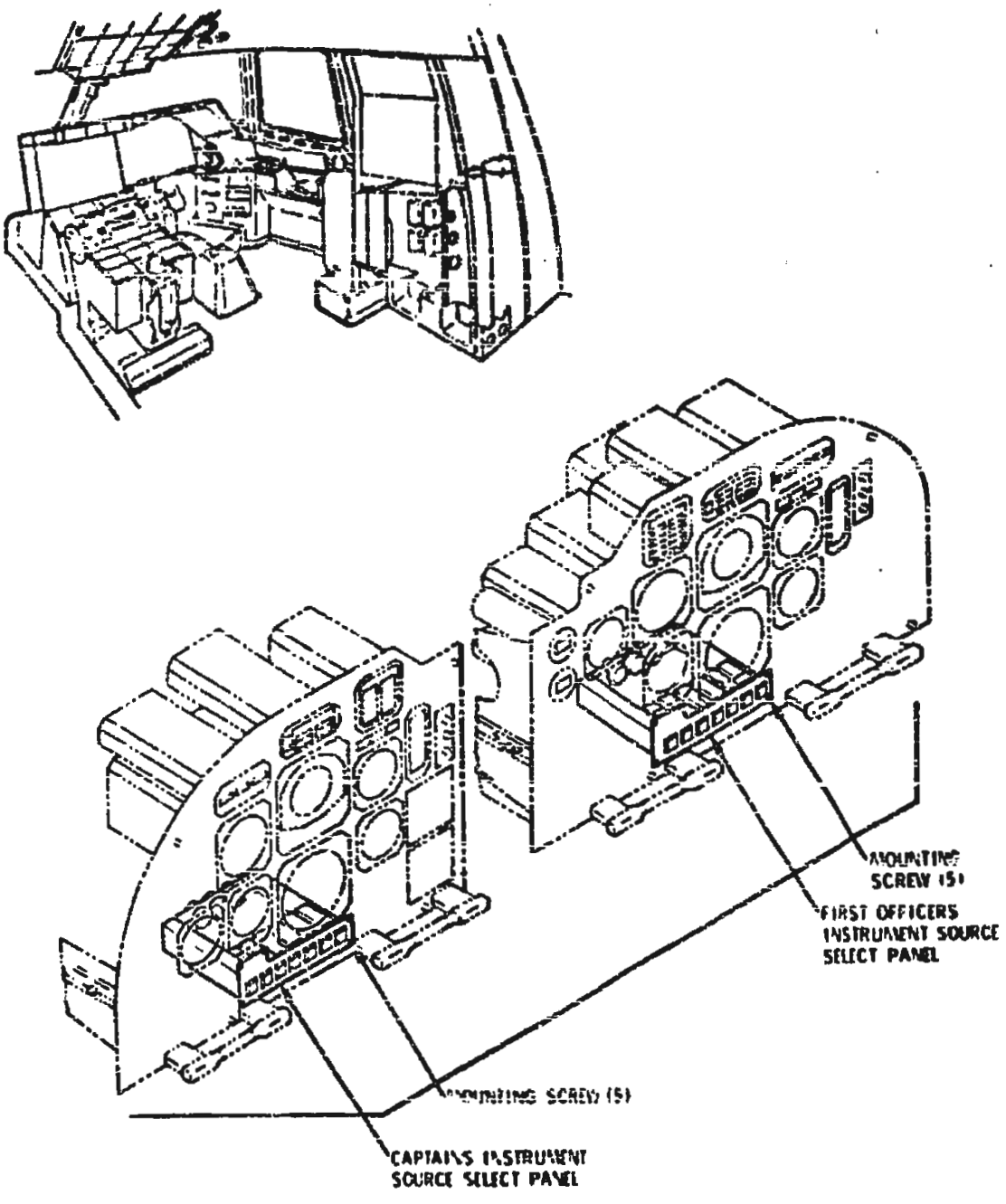
(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect aircraft connectors to receptacles on rear of panel.

(3) Place INSTRUMENT SOURCE SELECT panel in recess of Captains or First Officers instrument panel and secure by installing and tightening bolts. R

(4) Remove tags and close circuit breakers opened in Step 2A(1).

(5) Perform Instrument Source Select Panel Adjustment and Test (Ref. 34-00-01).


MOUNTING SCREW (5)
FIRST OFFICERS INSTRUMENT SOURCE SELECT PANEL
MOUNTING SCREW (5)
CAPTAINS INSTRUMENT SOURCE SELECT PANEL

HH 8758
A11-5003-34-205

R R Instrument Source Select Panel - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

INSTRUMENT SOURCE SELECT PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

24-00-00 Electrical Power System - Maintenance Practices

2. Adjustment/Test

A. Operational Test

(1) Turn on electrical power (Ref. 24-00-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breakers ALT SOURCE SEL - INSTR (E1) or INSTR (E2) are closed.

(3) On the Captains and First Officers INSTRUMENT SOURCE SELECT panels, release each source select switchlight to the normal position. Verify each ALTN light is out.

(4) Depress switchlights as listed in Table 501. Verify ALTN lights come on as listed in Table 501.

Instrument Source Select Panel Switchlight Settings
Table 501

SWLT	DEPRESS CAPT ALTN SWLT		DEPRESS F/O ALTN SWLT	
	F/O SWLT RELEASED	F/O SWLT DEPRESSED	CAPT SWLT RELEASED	CAPT SWLT DEPRESSED
	CAPT ALTN	F/O ALTN	F/O ALTN	CAPT ALTN
ALT	ON	OFF	ON	OFF
ATT	ON	ON	ON	ON
AS/M	ON	OFF	ON	OFF
FLT DIR	ON	ON	ON	ON
HDG	ON	OFF	ON	OFF
DEV	ON	OFF	ON	OFF
RNAV (Aircraft with INS)	ON	OFF	ON	OFF

Instrument Source Select Panel Switchlight Settings (Cont)
Table 501

SWLT	DEPRESS CAPT ALTN SWLT		DEPRESS F/O ALTN SWLT	
	F/O SWLT RELEASED	F/O SWLT DEPRESSED	CAPT SWLT RELEASED	CAPT SWLT DEPRESSED
	CAPT ALTN	F/O ALTN	F/O ALTN	CAPT ALTN
Release Capt and F/O SWLT				

(5) Turn off electrical power (Ref. 24-00-00).

FLIGHT ENVIRONMENT DATA SYSTEM - DESCRIPTION AND OPERATION

1. General

The flight environment data system is that portion of the navigation system which senses environmental conditions. The flight environmental data system consists of:

R Pitot-static systems (Ref. 34-13-00).

R Air Data Computer System (Ref. 34-14-00):

R Servoed altitude, airspeed/Mach, vertical speed, true airspeed indicator, static air temperature indicator
R (Ref. 34-15-00), total air temperature probes and
R standby pneumatic airspeed and altitude indicators.

Air temperature system (Ref. 34-15-00):

Static air temperature and total air temperature/rated EPR indicators.

Central instrument warning system (CIWS) (Ref. 34-16-00).

R Instrument Comparison Monitor

R Instrument Failure Warning Indicator

Equipment interfacing with the flight environment data system is limited to the pitot-static systems. These systems supply
R information to the air data computer systems, which, in turn supply information to the central instrument warning system.
R This interfacing is described within the air data computer system and in the central instrument warning system.

PITOT-STATIC SYSTEM- DESCRIPTION AND OPERATION

1. General

C The pitot-static system (Ref. Fig. 1) supplies pitot-static
C inputs for the standby instruments, the central air data
C computer system (Ref. 34-14-00), the Flight Engineer/Second
C Officer cabin differential pressure indicator and cabin pressure
CR control panel (Ref. 21-33-00), and (on aircraft with S934-179)
CR the windshear computer (Ref. 34-19-00).

C The two air data computers, the standby instruments, and the
C FE/SO panel units are provided with individual lines, making
C them independent of each other.

The air data computer outputs to the Captains and First Officers servoed flight instruments are bootstrapped, and are switchable using the instrument source select panels (Ref. 34-00-01).

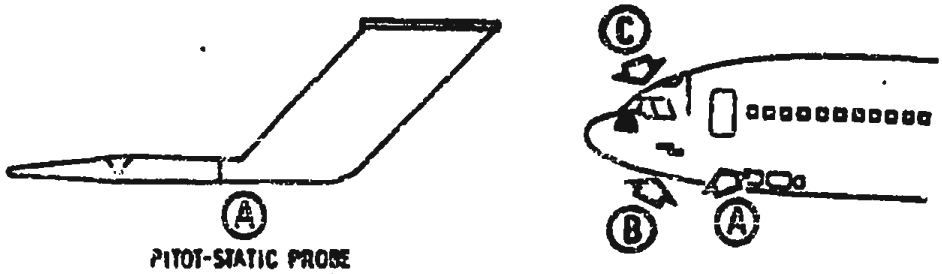
The pitot-static tubes and lines are self-draining and are provided with clear plastic drain bottles to permit monitoring and removal of trapped moisture.

Seven plastic drain bottles are located in zone 112; two at FS 219, LBL20; four at FS 250, LBL 20; and one at FS220, RBL 63. Two pitot tubes are located on each side (left and right) of the fuselage at zone 110, FS 222, WL 181; and zone 110, FS 230, WL 167.

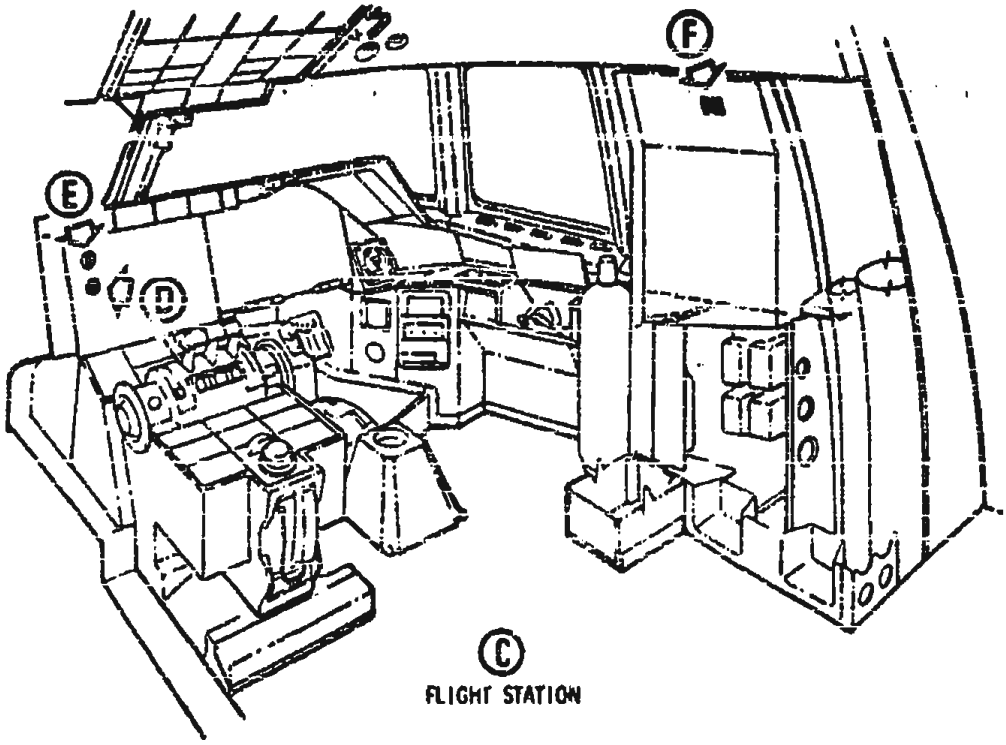
Each pitot and static line is provided with a capped T-fitting for test purposes.

2. Operation

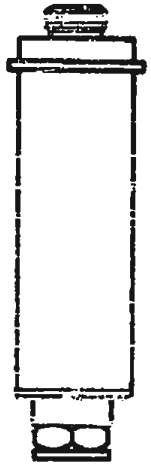
Pitot-static inputs are converted in the air data computers to provide electrical outputs to instruments on the Captains and First Officers instrument panel (Ref. Fig. 2). The electrical outputs from the air data computers can be switched to the Captains for First Officers instruments by pressing a switchlight on the Captains or First Officers INSTRUMENT SOURCE SELECT panel (Ref. 34-00-01). Pitot-static inputs operate the airspeed pointer on the standby airspeed indicator, the drum counter and pointer on the standby barometric altitude indicator, and the cabin differential pressure indicator on the Flight Engineer/Second Officers instrument panel.



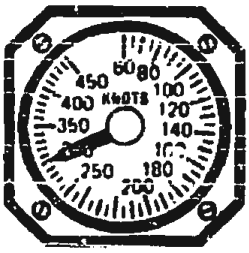
A
PITOT-STATIC PROBE
RIGHT AND LEFT SIDE (2 EACH)



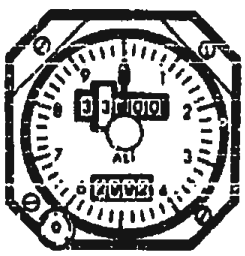
C
FLIGHT STATION



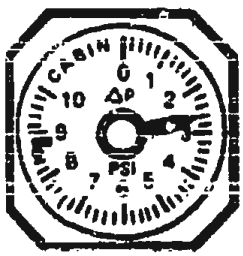
B
DRAIN BOTTLE
FESC
(7 EACH)



D
STANDBY PNEUMATIC
AIRSPEED INDICATOR



E
STANDBY PNEUMATIC
BAROMETRIC ALTIMETER



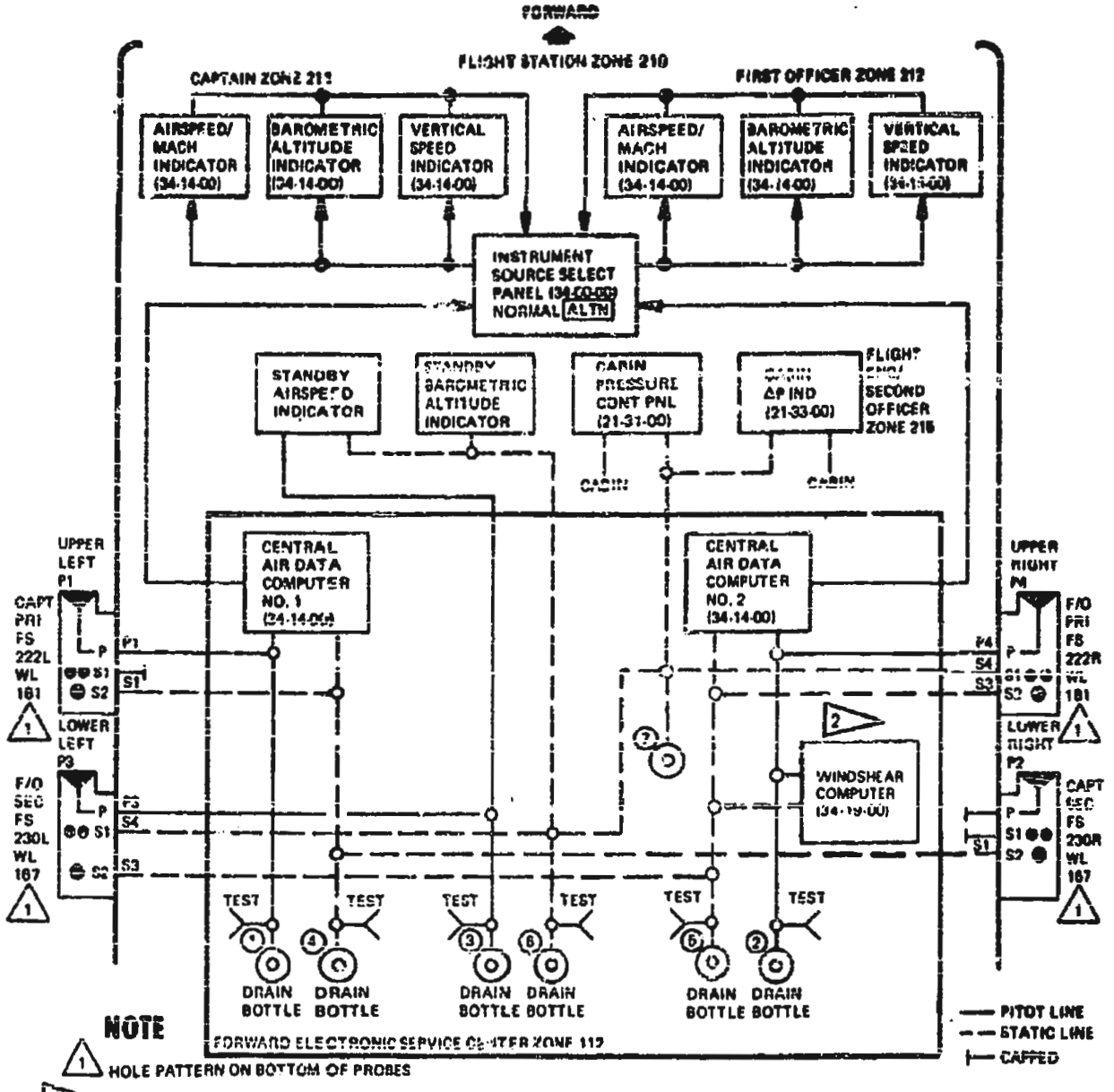
F
CABIN DIFFERENTIAL
PRESSURE INDICATION

A1-0002-34-2000

R
R
Pitot Static System
Figure 1

EFFECTIVITY: ALL

0028



NOTE

1. HOLE PATTERN ON BOTTOM OF PROBES
2. AIRCRAFT WITH S634-179

BOTTLE NO	TYPE	SYSTEM	LOCATION
①	PITOT	CAPT	FWD SIDE OF LEFT REAR RACK IN F.E.S.C.
②	PITOT	F/O	FWD SIDE OF LEFT REAR RACK IN F.E.S.C.
③	PITOT	SEC	BELOW AIDS RACK LEFT SIDE F.E.S.C.
④	STATIC	CAPT	FWD SIDE OF LEFT REAR RACK IN F.E.S.C.
⑤	STATIC	F/O	FWD SIDE OF LEFT REAR RACK IN F.E.S.C.
⑥	STATIC	SEC	BELOW AIDS RACK LEFT SIDE F.E.S.C.
⑦	STATIC	SEC	BELOW UPPER AT PROBE FS 220 WL 107 RBL 83

M1-0001-34-3400

R R Pitot Static System Block Diagram
Figure 2

3. Compensated Pitot-Static Tube

A. Description

Each pitot-static tube (Ref. Fig. 3) consists of a probe containing ram and static pressure sensing ports, a pitot drain hole, and an integral mounting strut used to locate the probe in the airstream away from the aircraft fuselage. Electrical and pneumatic connections are located in the base of the strut. Pitot (ram) pressure is sensed at the opening in the forward end of the probe. Static pressure ports are located in the contoured mid-section of the probe; the contoured surface provides aerodynamic compensation to the correct the static pressure position error caused by the aircraft. The contour configuration and port locations minimize errors due to Mach number and angle-of-attack. The pitot drain hole is located at the aft end of the probe. To prevent ice accumulation on the pitot-static tube during flight, both the tube and the strut contain a de-icing heater which is electrically connected to a two-pin connector in the strut baseplate. Two round dowel pins in the baseplane ensure accurate mechanical alignment of the installed tube.

Although the left and right pitot-static tubes are operationally identical, they are not interchangeable due to differences in static port and pitot drain hole locations. These differences are necessitated by the angle of installation on opposite sides of the fuselage.

The 115V ac, 400 Hz, hermetically sealed heater element is brazed into the tube and a recessed area in the baseplate. the heater is a self-regulating coaxial type which does not require thermostats. Temperature-compensating characteristics provide maximum power for in-flight operation and reduced power in still air (aircraft on ground) to prevent overheating.

B. Operation

For operation of the pitot heater system refer to 30-31-00.

R For operation of systems and components which receive pneumatic signals from the pitot-static tubes refer to the individual system or component (Ref. 34-13-00, 34-14-00, and 34-19-00).

4. Standby Airspeed Indicator (Pneumatic)

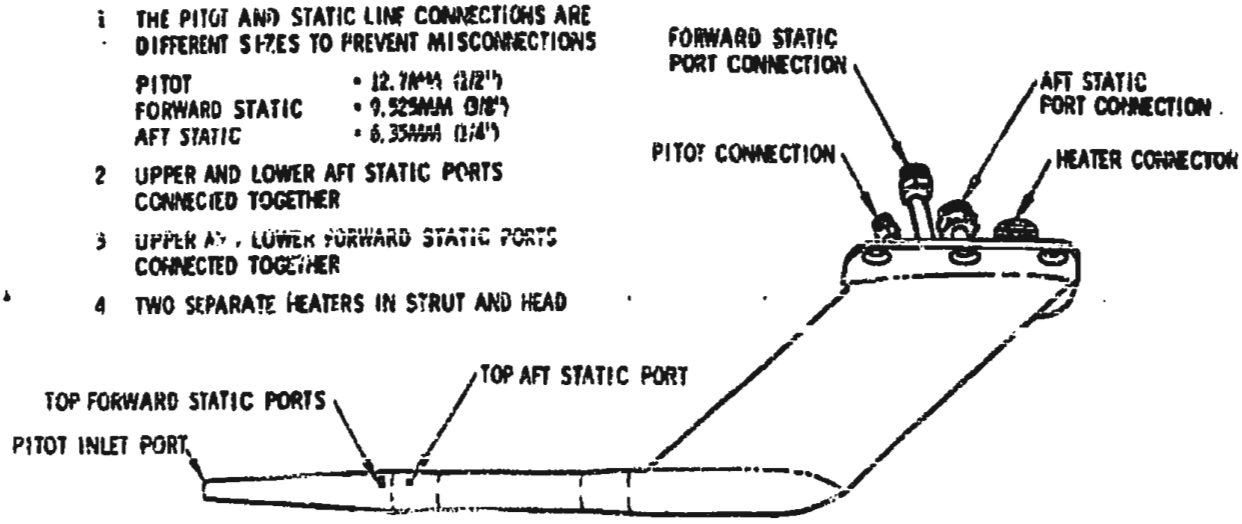
A. Description and Operation

NOTE

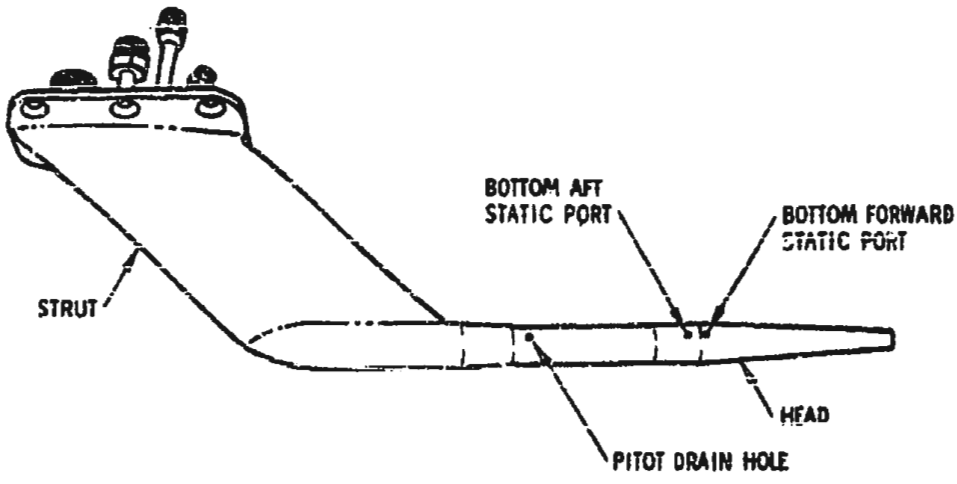
1. THE PITOT AND STATIC LINE CONNECTIONS ARE DIFFERENT SIZES TO PREVENT MISCONNECTIONS

PITOT	• 12.7MM (1/2")
FORWARD STATIC	• 9.525MM (3/8")
AFT STATIC	• 6.35MM (1/4")

2. UPPER AND LOWER AFT STATIC PORTS CONNECTED TOGETHER
3. UPPER AFT, LOWER FORWARD STATIC PORTS CONNECTED TOGETHER
4. TWO SEPARATE HEATERS IN STRUT AND HEAD



VIEW LOOKING DOWN ON PROBE AS MOUNTED (LH SIDE)



VIEW LOOKING UP AT PROBE AS MOUNTED (LH SIDE)

M1-0101-34-2007

R
R

Pitot Static Probe
Figure 3

The pneumatic standby airspeed indicator is a direct reading indicator with a lighted dial. The indicator is housed in an ARINC 2 ATI case which is mounted on the pilots center instrument panel, zone 210. A PT (pitot) port and a PS (static) port connector on the rear of the case provide pitot and static line connections to the instrument. A single electrical connector provides the 5V ac electrical power connection for dial lighting.

The instrument functions by means of ram air pressure. Air is introduced into the pitot tube, into a capsule, and vented to a static pressure port. The capsule expands and contracts with the amount of ram air pressure, which moves mechanical linkage connected to a pointer (indicator). The pointer moves around the dial face to indicate airspeed from 60 to 450 knots.

NOTE: The Standby Airspeed Indicator has an access plate on the side of the indicator. This plate provides access to the static chamber; therefore, it should not be removed in an attempt to replace burned out light bulbs. Indicators with burned out lights should be returned to the shop.

5. Standby Barometric Altitude Indicator (Pneumatic)

A. Description and Operation

The pneumatic standby barometric altitude indicator is a direct reading indicator with a lighted dial. The indicator is housed in an ARINC 2 ATI case which is mounted on the pilots center instrument panel, zone 210. The indicator functions using static pressure applied to a rear static connector. This static pressure is applied to diaphragms which expand and contract with static pressure. The expansion and contraction of the diaphragms is transmitted mechanically to a drum counter and pointer. The altitude indicator counter displays thousands and tens of thousands of feet. The pointer indicates altitude in hundreds of feet. Altitude is displayed from -1000 to 50,000 feet. A barometric set adjustment knob is located in the lower left corner of the indicator. This knob allows the altitude display to be compensated for local barometric pressure which is displayed on a counter at the bottom of the indicator in inches of mercury (Hg). A rear power connector connects 5V ac to the indicator for integral lighting.

CR

PITOT/STATIC SYSTEMS - MAINTENANCES PRACTICES

CR 1. General

CR Standard practices pertaining to pitot/static systems are
CR contained in this section as well as operational instructions
CR for all required test equipment.

CR 2. Pitot and Static Test Adapter PSS-55711-4-4-4 TWA Stk. Nbr.
CR 248-2165

CR A. Provides method of connecting test equipment to aircraft
CR pitot and static systems, without opening a line.

CR B. Installation Procedure

CR (1) Lubricate adapter with water or alcohol to facilitate
CR installation.

CR (2) Leak check adapter with GEN 3119 test plug, prior to
CR installation on aircraft.

CR (a) Loosen compression nut all the way out of adapter.

CR (b) Insert test plug into open end of adapter until
CR plug b[illegible]s out on bumper pad at closed end of
CR adapte[illegible]. (Ref. Fig. 201.)

CR (c) Tighten compression nut by turning into adapter
CR hand tight.

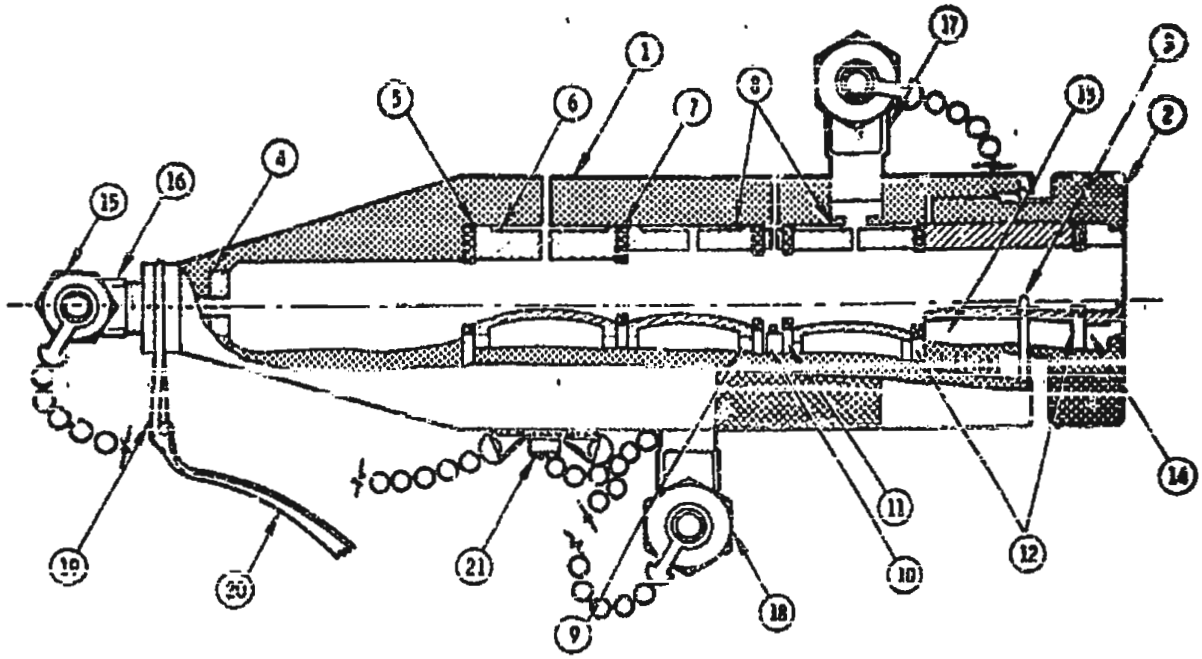
CR (d) Apply pressures with pitot/static tester RR 90071
CR to each part on adapter.

CR (e) Leakage rates should not exceed one knot per
CR minute at 400 knots on pitot or 10 feet per minute
CR at 3000 feet on static.

CR (f) If leakage occurs examine internal seals for
CR nicks, cuts, etc. Replace as required. (Ref.
CR Fig. 201.)

CR (3) Install adapter on aircraft pitot/static probe in the
CR same manner as on test plug.

CR CAUTION: 1: ASSURE THAT COMPRESSION NUT IS BACKED ALL THE WAY
CR OUT OF ADAPTER PRIOR TO INSTALLING OR REMOVING FROM
CR PROBE.



ITEM NO.	DESCRIPTION	PART NO.	NO. PER ASSY
1	BODY	711-11	1
2	COMPRESSION NUT	711-21	1
3	CIRCLIP	711-141	1
4	TEFLON SNUBBER	711-31	1
5	GLAND	711-41	1
6	SPACER	711-51	1
7	GLAND	711-61	1
8	SPACER	711-71	2
9	GLAND	711-81	1
10	SPACER	711-91	1
11	GLAND	711-101	1
12	GLANDS	711-121	2
13	SPACER	711-111	1
14	COLLAR	711-131	1
15	BLANKING CAP ASSY	711-161	1
16	FITTING	AN-822	1
17	FITTING	AN-822	2
18	BLANKING CAP ASSY	711-171	2
19	STREAMER CLIP	711-181	1
20	STREAMER ASSY	711-191	1
21	SCREW	711-151	1

M1-0001-34-3616

CR
CR

Pitot and Dual Static Test Adapter
Figure 201

EFFECTIVITY: ALL

002B

C CAUTION: 2: LUBRICATE ADAPTER WITH WATER OR ALCOHOL.

C CAUTION: 3: ASSURE THAT FORWARD TIP OF PROBE BOTTOMS ON BUMPER
C PAD OF ADAPTER.

C C. Adapter Gland Seal Replacement.

C (1) Remove circlip (Item 3, Fig. 201) by inserting awl or
C other sharp pointed tool into small holes in body of
C adapter and pushing circlip down then pry out with
C small screwdriver.

C (2) Using test plug as a holder remove gland seals and
C spacers and stack on plug in order removed.

C (3) Replace gland seals using Mfg. P/N SK711, TWA Stk. Nbr.
C 48-2164 seal kit.

C CAUTION: ASSURE THAT CONNECT SEAL FOR EACH LOCATION IS USED.
C (REFER TO FIG. 201.)

C 3. MB-1 Pitot Static Tester R & R 90071

C A. General

C A portable pitot/static test set using hand operated vacuum
C and pressure pumps, that is intended for field use to leak
C test pitot and static systems, and operational checks of the
C various instruments connected to the pitot and static
C systems.

C B. Preparation for Use

C CAUTION: THE NEEDLE VALVE CONTROLS ARE SENSITIVE VALVES AND
C SHOULD NOT BE CLOSED WITH UNNECESSARY FORCE.

C (1) Close all valves and cap pitot hose connection.

C (2) Pressurize the pressure tank to 50" hg gauge reading
C with hand pump then lock pump handle in place.

C (3) Open pressure valve slowly until airspeed indicator
C shows a reading of 500 knots.

C CAUTION: OBSERVE THAT ALTIMETER DOES NOT MOVE WHEN
C INCREASING PITOT PRESSURE.

C (4) Close pressure valve and check that airspeed indicator
C reading does not decrease more than 1 knot in a one
C minute period.

C (5) Open vent valve slowly until airspeed indicator returns
C to zero (approximately 40 knots).

C (6) Close all valves and cap static outlet. Evacuate
C vacuum tank by means of hand pump to 20" hg.

C (7) Slowly open vacuum valve until airspeed indicator reads
C 500 knots. Observe that altimeter reading increases.
C Close vacuum valve and check that airspeed does not
C decrease more than 1 knot in a one minute period.

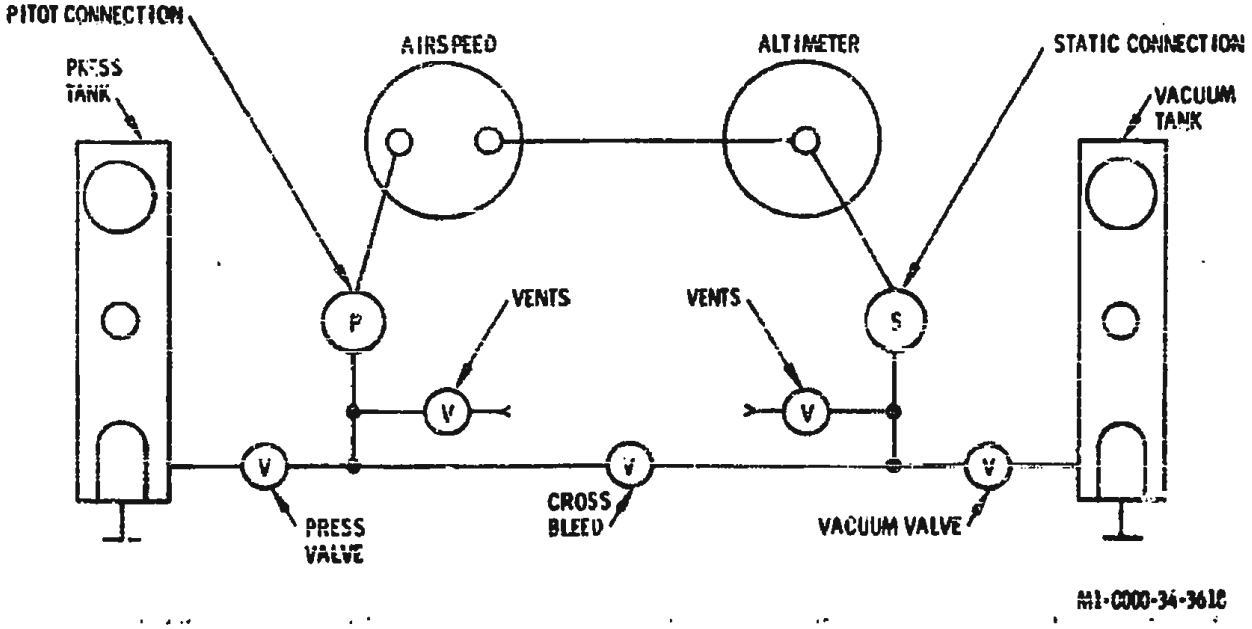
C (8) Open vacuum vent valve slowly until airspeed returns to
C zero.

C C. Operating Instructions

C (1) Connect rubber hoses to the pitot and static
C connections and to the applicable systems on the
C aircraft by means of the adapters.

C (2) Close all valves and apply pressure and vacuum to the
C tanks with hand pumps.

C (3) Leak check aircraft systems prior to any high altitude
C checks as follows:



C Schematic - MB-1 Pitot/Static Tester
C Figure 202

R EFFECTIVITY: ALL
R
002B

(a) Slowly open vacuum valve until altimeter increases 3000 feet, close valve and observe that altimeter does not decrease more than 60 feet in one minute.

(b) Open vacuum vent valve and permit altimeter to return to field elevation.

(c) Slowly open pressure valve until airspeed reads 300 knots, close valve and observe that indicator does not decrease more than 4 knots in a one minute period.

(d) Open pressure vent valve and return system to zero pressure.

(4) When high altitude checks are required perform as follows:

(a) Slowly open vacuum valve and cross bleed valve.

CAUTION: PERMIT AIRSPEED INDICATOR TO INCREASE TO APPROXIMATELY 200 KNOTS THEN OPERATE CROSS BLEED VALVE TO MAINTAIN THIS READING WHILE INCREASING ALTITUDE.

NOTE: Use hand pump to maintain a vacuum of approximately 11" hg in vacuum tank.

(b) When reaching test altitude close vacuum valve to maintain reading.

(c) When reducing vacuum to field elevation use vacuum vent valve and again operate cross bleed so as to maintain a reading of 200 knots on the airspeed indicator.

4. Pitot/Static Probe Alignment Inclinometer

A. Description and Operation

(1) If the instrument has not been used for several hours, agitate the pendulum scale before use.

(a) Unlock inclinometer by turning the center knob clockwise.

(b) Hold the clinometer in both hands and describe a circular motion so that the drum scale is spun around.

NOTE: This action can be quite vigorous without causing any harm to the instrument. The purpose is to distribute the oil evenly in the ball races to eliminate drag.

(2) Unlock the drum, place the instrument on the surface to be measured. Let the scale come to rest.

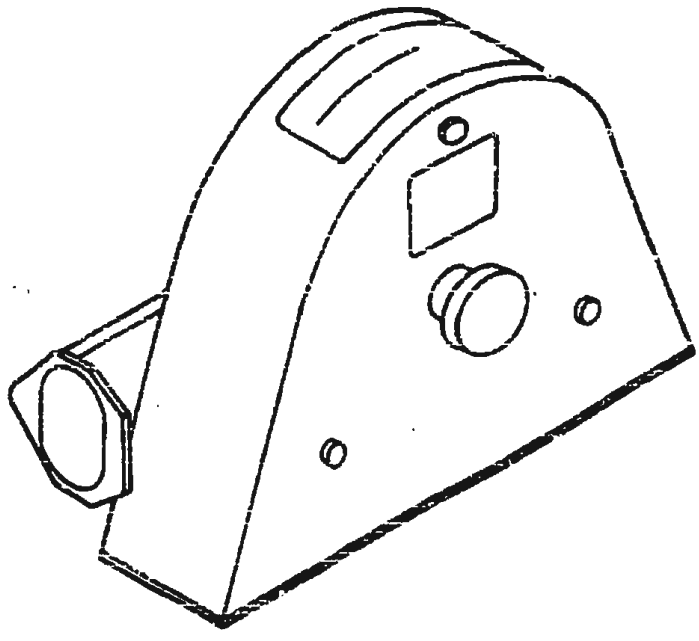
NOTE: Excessive movement of the scale may be damponed by partial application of the locking devices. The scale should not be allowed to come to rest completely in this condition. The last 10 oscillations should be with the drum completely free.

(3) Lock the drum carefully without disturbing the setting. The instrument can now be handled freely without affecting the reading.

(4) The drum is engraved 0° - 180° either side of zero. The figures to the left are black and those to the right are red. Whole degrees are read from the moving drum scale and the minutes 0° - 60° are read from the fixed vernier scale.

(5) The index mark is engraved on the vernier scale and its position is indicated by a white line engraved on the case. When taking a reading, if the index mark is between two degrees the lower one should be read and the reading on the vernier scale added to it.

(6) The vernier reading is taken from the point where a vernier scale coincides with a division on the drum scale. The vernier scale is marked with two sets of figures, black and red. If the index mark is on the black portion of the drum scale; use the block figures on the vernier. If the index mark is on the red portion, use the red figures on the vernier.



M1-0000-34-3619

C Pitot/Static Probe Alignment Inclinometer
C Figure 203

R EFFECTIVITY: ALL
R
002B

CR

PITOT-STATIC SYSTEM - ADJUSTMENT/TEST

CR 1. General

CR A. The pitot and static systems are dynamic and ambient air-operated systems for which no operational check is practical, but a leak check should be performed whenever a system connection has been opened to ensure system integrity. A functional test for the pneumatic instruments is included.

CR B. There are two types of static system leak tests that can be performed, a low altitude test that is required for a static system unit replacement or a high altitude test that is required at certain maintenance checks or after major rework or modification to a static system.

CR (1) A 26,000 feet leak check is required as follows:

CR (a) At base overhaul

CR (b) For any major rework or modification of static system tubing

CR (c) When a high altitude altimeter spread condition becomes repetitive, and no fault is located with a 3000 feet leak check.

CR Figure 501 is a Pitot-Static System component locator diagram.

CR WARNING: INSTALL RAM AIR TURBINE (RAT) GROUND SAFETY LOCK (REF. 29-21-00).

CR 2. Reference Procedures

CR	21-33-04	Indicator - Cabin Differential Pressure - Removal and Installation
CR	34-13-01	Probe, Compensated Pitot-Static - Removal and Installation
CR	34-13-02	Drain Bottle - Pitot Static - Removal and Installation
CR	34-13-03	Indicator (Pneumatic) - Standby Airspeed - Removal and Installation
CR	34-13-04	Indicator (Pneumatic) - Standby Barometric Altitude

CR - Removal and Installation

CR 34-14-01 Computer - Air Data - Removal and Installation

CR 3. Equipment and Materials

CR A. Type MB-1 Pitot/Static field tester, Burton 2024B
CR Pitot/Static tester or equivalent.

CR (1) Refer to chapter 34 of Illustrated Tool and Equipment
CR Manual for description and operation.

CR B. Flush static port adapter. Ref. TWA Illustrated Tool &
CR Equipment Manual 21-31-02-0023 (TWA Stk Nbr 48-3193).

CR C. Pitot/Static probe adapter PSS55711.

CR D. Electricians tape TWA Stk. Nbr. 41-2251 or 41-2252 or
CR equivalent.

CR E. Probe adapter leak test plug GEN3119.

CR F. Ram Air Turbine (RAT) Ground Safety Lock (Ref. 29-21-00).

CR 4. Pitot - Static System Leak Test

CR A. Precautions.

CR (1) Rate of application or release of vacuum to a static
CR system must not exceed a rate of climb or descent
CR equivalent to 5000 feet per minute.

CR (2) Any application or release of pressure to a pitot
CR system must not exceed a rate of 300 knots per minute.

CR (3) Absolute pressure in the pitot system must never be
CR less than the pressure in the static system. The
CR maximum difference between pitot and static system
CR pressures must never exceed 10 inches of mercury
CR (approximately 434 knots).

CR (4) The absolute pressure applied to a static system should
CR never exceed the ambient pressure when any instrument
CR is connected to that static system.

CR (5) Pitot-static probe heaters must not be activated under
CR any circumstances during tests that require
CR pitot-static probe adapters to be attached to any
CR pitot-static probe. Place DO NOT OPERATE signs on
CR probe heater switch lights. (Refer to 30-31-00).

C (6) A leak test of pitot/static tester and probe adapter
C should be made prior to any aircraft leak test, (Use
C GEN3119 adapter test plug to seal adapter for test).

C (7) Ensure autoflight system is disengaged; both A and B
C bathandles down on APFD engage panel. If either or
C both bathandle is up, with electrical power on
C aircraft, press autopilot disconnect switch on either
C control wheel.

C (8) No lubricant other than clean water or alcohol is to be
C used when installing any pitot-static tube adapter.

C (9) When testing Captains or First Officers primary
C pitot-static system; ensure circuit breakers FLAP LOAD
C RELIEF CHAN 1 (H12) and FLAP LOAD RELIEF CHAN 2 (H20)
C on FE/SO overhead circuit breaker panel CB2 are open.

C (10) On pilots overhead circuit breaker panel, CB1, open and
C tag circuit breakers RAT MAN DEPLOY (B14) and RAT AUTO
C DEPLOY (L3).

CR (11) ATC Transponder is in standby mode.

C B. Pitot and Static Systems (P1 and S1) Leak Test (ADC No. 1)

C (1) Verify that the following circuit breakers are in and
C no fail flags are showing in Captains servoed
C altimeter, airspeed/Mach indicator or vertical speed
C indicator.

C (a) AIR DATA COMPTR (G8) on CB-1

C (b) IAS/MACH (F1) on CB-1

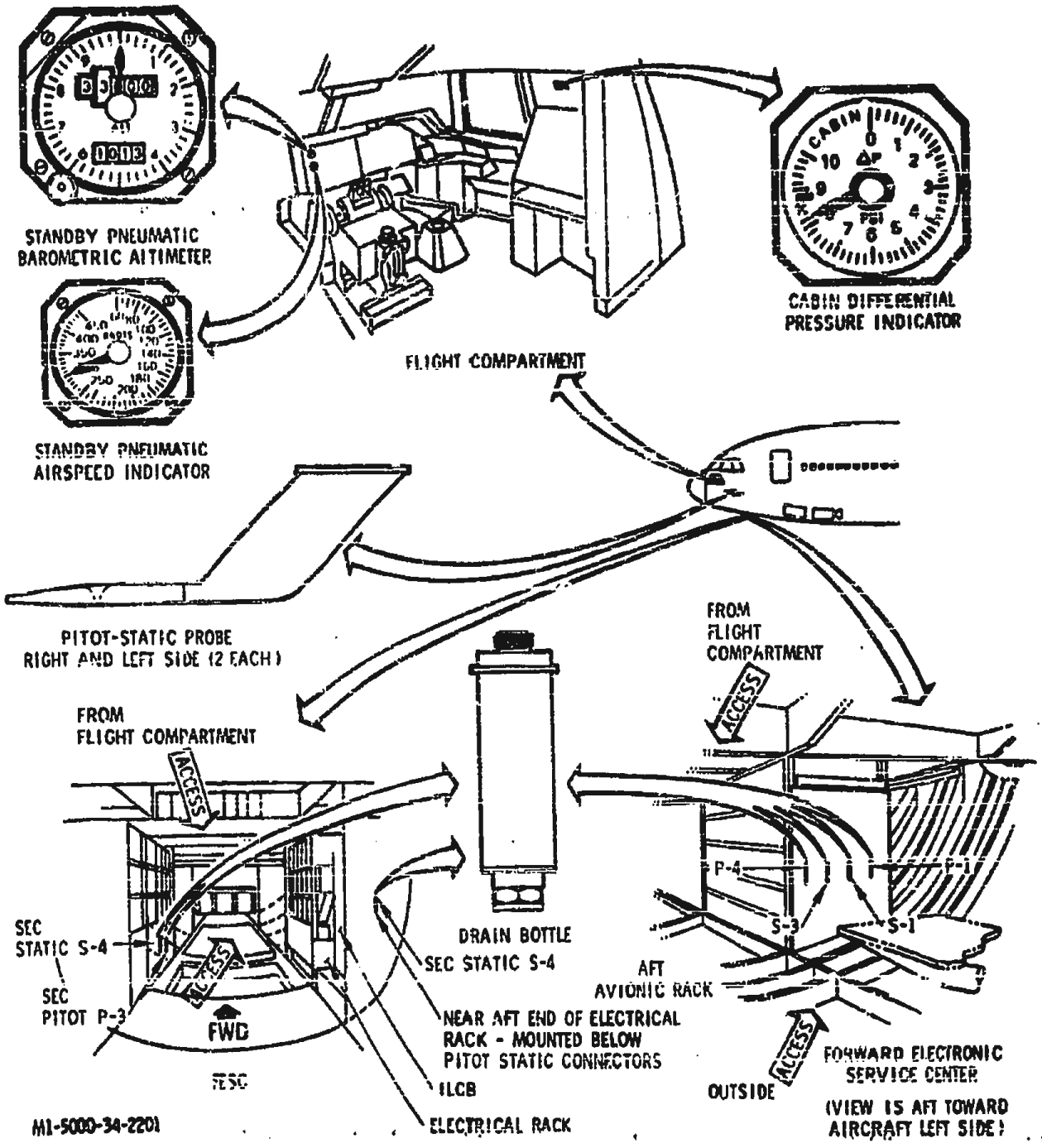
C (c) ALTM (F4) on CB-1

C (d) VERT SP IND (E4) on CB-1

C NOTE: No instrument source select switch lights
C should be illuminated at this time.

C WARNING: NO LUBRICANT OTHER THAN CLEAN WATER OR ALCOHOL IS
C TO BE USED WHEN INSTALLING ANY PITOT-STATIC PROBE
C ADAPTER.

C ENSURE CIRCUIT BREAKERS FLAP LOAD RELIEF CHAN 1
C (H12), FLAP LOAD RELIEF CHAN 2 (H20) on FE/SO
C OVERHEAD CIRCUIT BREAKER PANEL CB2; AND RAT MAN
C DEPLOY (B14), RAT AUTO DEPLOY (L3) ON PILOTS
C OVERHEAD CIRCUIT BREAKER PANEL CB1 ARE OPEN.



CR
CR

Pitot-Static System Component Locator
Figure 501

EFFECTIVITY: ALL

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CR CAUTION: PITOT-STATIC PROBES ARE DELICATE INSTRUMENTS AND CRITICALLY ALIGNED ON THE AIRCRAFT. EXTREME CARE MUST BE EXERCISED WHEN HANDLING. TEST HOSES AND ADAPTERS MUST BE SUPPORTED IN SUCH A WAY AS TO ADD NO EXTRA WEIGHT ON PROBES.

CR (2) Install pitot/static adapter PSS55711 on upper left probe.

CR (3) Using electricians tape, seal pitot water drain hole on probe. Note drain hole is located on bottom aft side of probe.

CR (4) Connect pitot (pressure) source of test unit to pitot fitting on adapter (forward connection on adapter).

CR (5) Connect static (vacuum) source of test unit to S2 connection on adapter (aft connection on adapter).

CR (6) Seal S2 static orifices on lower right probe using electricians tape (TWA Stk Nbr 41-2251 or 41-2252) or a second pitot/static probe adapter.

CR NOTE: Apply tape so only the S2 static orifices are covered, or if adapter is being used remove cap on S1 port.

CR (7) OPEN static vent valve and CLOSE cross-bleed valve on test unit.

CR CAUTION: DO NOT EXCEED A RATE OF 300 KNOTS PER MINUTE.

CR (8) CLOSE pitot vent valve and SLOWLY OPEN pitot pressure valve until Captains airspeed/Mach indicator indicates 350 knots.

CR (9) When system has stabilized CLOSE pitot pressure valve and record Captains airspeed indicator reading.

CR (10) After one minute Captains airspeed/Mach indicator shall not have decreased more than 5 knots from reading recorded in Step (9).

CR (11) After pitot leak check is complete SLOWLY OPEN pitot vent valve and return pitot system to ambient pressure.

CR (12) Set Captains altimeter baro scale so altimeter indicates field elevation.

CR CAUTION: DO NOT EXCEED A 5000 FEET PER MINUTE RATE OF CLIMB.

CR (13) CLOSE static vent valve and SLOWLY OPEN static vacuum valve until Captains altimeter indicates 3000 feet above field elevation.

CR (14) When system has stabilized CLOSE static vacuum valve and record Captains altimeter reading.

CR (15) After one minute Captains altimeter shall not have decreased more than 60 feet.

CR NOTE: If only a low altitude leak check is required proceed to Step (20).

CR CAUTION: DO NOT EXCEED A RATE OF CLIMB OF 5000 FEET PER MINUTE, AND KEEP AIRSPEED INDICATION BETWEEN 150 KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (16) CLOSE pitot vent valve, SLOWLY OPEN static vacuum valve and cross bleed valve. Maintain an airspeed indication of approximately 250 knots by using cross bleed valve while increasing altitude to 26,000 feet as read on Captains altimeter.

CR (17) When system has stabilized CLOSE static vacuum valve and record Captains altimeter reading.

CR (18) After one minute Captains altimeter shall not have decreased more than 400 feet.

CR CAUTION: DO NOT EXCEED A RATE OF DESCENT OF 5000 FEET PER MINUTE, AND MAINTAIN AN AIRSPEED INDICATION BETWEEN 150 KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (19) OPEN static vent valve, and permit altitude to decrease. Maintain an airspeed indication of approximately 250 knots while decreasing altitude, by use of cross-bleed valve.

CR (20) Permit altitude to decrease to field elevation by operation of static vent valve, then CLOSE valve.

CR (21) Position pitot vent valve OPEN, cross bleed valve CLOSE.

CR (22) SLOWLY OPEN static vacuum valve until Captains altimeter indicates 300 feet above field elevation.

CR (23) When system has stabilized CLOSE static vacuum valve.

CR (24) Remove seal from S2 static orifice on lower right probe. Observe that Captains altimeter decreases to field elevation.

CR (25) Remove adapter from upper left probe and remove tape CR from pitot drain hole.

CR (26) Close circuit breakers FLAP LOAD RELIEF CHAN 1 (H12) CR and FLAP LOAD RELIEF CHAN 2 (H20) on FE/SO overhead CR circuit breaker panel CB 2.

CR CAUTION: FAILURE TO REMOVE TAPE AND ASSURE THAT STATIC ORIFICES CR ARE OPEN AND CLEAR CAN RESULT IN INACCURATE READINGS CR ON THE INSTRUMENTS ASSOCIATED WITH THIS SYSTEM.

CR C. First Officers Primary Pitot and Static Systems Leak Test

CR (1) Verify that the following circuit breakers are in and CR no fail flags are showing in F/O servoed altimeter, CR airspeed/Mach indicator or vertical speed indicator.

CR (a) AIR DATA CMPTR (G27) on CB-1

CR (b) IAS/MACH (F19) on CB-1

CR (c) ALTM (F22) on CB-1

CR (d) VERT SP IND (E21) on CB-1

CR NOTE: No instrument source select switch lights CR should be illuminated at this time.

CR WARNING: NO LUBRICANT OTHER THAN CLEAN WATER OR ALCOHOL IS CR TO BE USED WHEN INSTALLING ANY PITOT-STATIC PROBE CR ADAPTER.

CR ENSURE CIRCUIT BREAKERS FLAP LOAD RELIEF CHAN 1 CR (H12), FLAP LOAD RELIEF CHAN 2 (H20) ON FE/SO CR OVERHEAD CIRCUIT BREAKER PANEL CB 2; AND RAT MAN CR DEPLOY (B14), RAT AUTO DEPLOY (L3) ON PILOTS CR OVERHEAD CIRCUIT BREAKER PANEL CB1 ARE OPEN.

CR CAUTION: PITOT-STATIC PROBES ARE DELICATE INSTRUMENTS AND CR CRITICALLY ALIGNED ON THE AIRCRAFT. EXTREME CARE CR MUST BE EXERCISED WHEN INSTALLING REMOVING OR CR HANDLING. TO PREVENT PROBE MISALIGNMENT, TEST CR HOSES AND ADAPTERS MUST BE SUPPORTED IN SUCH A WAY CR AS TO ADD NO EXTRA WEIGHT ON PROBES.

CR (2) Install pitot/static adapter PSS55711 on upper right CR probe.

CR (3) Using electricians tape, seal pitot water drain hole on CR probe.

CR NOTE: Drain hole is located on bottom aft side of
CR probe.

CR (4) Connect pitot (pressure) source of test unit to pitot
CR fitting on adapter (forward connection on adapter).

CR (5) Connect static (vacuum) source of test unit to S2
CR connection on adapter (aft connection on adapter).

CR (6) Seal S2 static orifices on lower left probe using
CR electricians tape (TWA Stk Nbr 41-2251 or 41-2252) or a
CR second pitot/static probe adapter.

CR NOTE: Apply tape so only the S2 static orifices are
CR covered, or if an adapter is being used remove
CR cap on S1 port.

CR (7) OPEN static vent valve and CLOSE cross-bleed valve on
CR test unit.

CR CAUTION: DO NOT EXCEED A RATE OF 300 KNOTS PER MINUTE.

CR (8) CLOSE pitot vent valve and SLOWLY OPEN pitot pressure
CR valve until F/O airspeed indicator reads 350 knots.

CR (9) When system has stabilized CLOSE pitot pressure valve
CR and record F/O airspeed indicator reading.

CR (10) After one minute the F/O airspeed/Mach indicator shall
CR not have decreased more than 5 knots from reading
CR recorded in Step (9).

CR (11) After pitot leak check is complete SLOWLY OPEN pitot
CR vent valve and return pitot system to ambient pressure.

CR (12) Set F/O altimeter baro scale so altimeter indicates
CR field elevation.

CR CAUTION: DO NOT EXCEED A 5000 FEET PER MINUTE RATE OF
CR CLIMB.

CR (13) CLOSE static vent valve and SLOWLY OPEN static vacuum
CR valve until F/O altimeter indicates 3000 feet above
CR field elevation.

CR (14) When system has stabilized CLOSE static vacuum valve
CR and record F/O altimeter reading.

CR (15) After one minute F/O altimeter shall not have decreased
CR more than 60 feet.

CR NOTE: If only a low altitude leak check is required
CR proceed to Step (20).

CR CAUTION: DO NOT EXCEED A RATE OF CLIMB OF 5000 FEET PER
CR MINUTE, AND KEEP AIRSPEED INDICATION BETWEEN 150
CR KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (16) CLOSE pitot vent valve and SLOWLY OPEN static vacuum
CR valve and cross-bleed valve. Maintain an airspeed
CR indication of approximately 250 knots by using
CR cross-bleed valve while increasing atltiude to 26,000
CR feet as read on F/O altimeter.

CR (17) When system has stabilized CLOSE static vacuum valve
CR and record F/O altimeter reading.

CR (18) After one minute F/O altimeter shall not have decreased
CR more than 400 feet.

CR CAUTION: DO NOT EXCEED A RATE OF DESCENT OF 5000 FEET PER
CR MINUTE, AND MAINTAIN AN AIRSPEED INDICATION
CR BETWEEN 150 KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (19) OPEN static vent valve, and permit altitude to
CR decrease. Maintain an airspeed indication of
CR approximately 250 knots while decreasing altitude, by
CR use of cross-bleed valve.

CR (20) Permit altitude to decrease to field elevation by
CR operation of static vent valve, then CLOSE valve.

CR (21) Position pitot vent valve OPEN, and cross bleed valve
CR CLOSE.

CR (22) SLOWLY OPEN static vacuum valve until F/O altimeter
CR indicates 300 feet above field elevation.

CR (23) When system has stabilized CLOSE static vacuum valve.

CR (24) Remove seal from S2 static orifice on lower left probe.
CR Observe that F/O altimeter decreases to field
CR elevation.

CR (25) Remove adapter from upper right probe and remove tape
CR from pitot drain hole.

CR (26) Close circuit breakers FLAP LOAD RELIEF CHAN 1 (H12)
CR and FLAP LOAD RELIEF CHAN 2 (H20) on FE/SO overhead
CR circuit breaker panel CB2.

CR CAUTION: FAILURE TO REMOVE TAPE AND ASSURE THAT STATIC ORIFICES
CR ARE OPEN CAN RESULT IN INACCURATE READINGS ON THE
CR INSTRUMENTS ASSOCIATED WITH THIS SYSTEM.

CR D. Secondary Pitot and Static Systems Leak Test

CR WARNING: NO LUBRICANT OTHER THAN CLEAN WATER OR ALCOHOL IS
CR TO BE USED WHEN INSTALLING ANY PITOT-STATIC TUBE
CR ADAPTER.

CR CAUTION: PITOT-STATIC PROBES ARE DELICATE INSTRUMENTS AND
CR CRITICALLY ALIGNED ON THE AIRCRAFT. EXTREME CARE
CR MUST BE EXERCISED WHEN INSTALLING, REMOVING OR
CR HANDLING. TO PREVENT PROBE MISALIGNMENT, TEST
CR HOSES AND ADAPTERS MUST BE SUPPORTED IN SUCH A WAY
CR AS TO ADD NO EXTRA WEIGHT ON PROBES.

CR (1) Install pitot/static adapter PSS55711 on lower left
CR probe.

CR (2) Using electricians tape, seal pitot water drain hole on
CR probe.

CR NOTE: Drain hole is located on bottom aft side of
CR probe.

CR (3) Connect pitot (pressure) source of test unit to pitot
CR fitting on adapter (forward connection on adapter).

CR (4) Connect static (vacuum) source of test unit to S1
CR connection on adapter (center connection on adapter).

CR (5) Seal S1 static orifices on upper right probe using
CR electricians tape (TWA Stk Nbr 41-2251 or 41-2252) or a
CR second pitot/static probe adapter.

CR NOTE: Apply tape so only the S1 static orifices are
CR covered, or if an adapter is being used remove
CR cap on S2 port.

CR (6) OPEN static vent valve and CLOSE cross-bleed valve on
CR test unit.

CR CAUTION: DO NOT EXCEED A RATE OF 300 KNOTS PER MINUTE.

CR (7) CLOSE pitot vent valve and SLOWLY OPEN pitot pressure
CR valve until standby airspeed indicator reads 350 knots.

CR (8) When system has stabilized CLOSE pitot pressure valve
CR and record standby airspeed indicator reading.

CR (9) After one minute standby airspeed indicator shall not CR have decreased more than 5 knots from reading recorded CR in Step (8).

CR (10) After pitot leak check is complete SLOWLY OPEN pitot CR vent valve and return pitot system to ambient pressure.

CR (11) Set standby altimeter baro scale so altimeter reads CR field elevation.

CR CAUTION: DO NOT EXCEED A 5000 FEET PER MINUTE RATE OF CR CLIMB.

CR (12) CLOSE static vent valve and SLOWLY OPEN static vacuum CR valve until standby altimeter indicates 3000 feet above CR field elevation.

CR (13) When system has stabilized CLOSE static vacuum valve CR and record standby altimeter reading.

CR (14) After one minute standby altimeter shall not have CR decreased more than 60 feet.

CR NOTE: If only a low altitude leak check is required CR proceed to Step (19).

CR CAUTION: DO NOT EXCEED A RATE OF CLIMB OF 5000 FEET PER CR MINUTE, AND KEEP AIRSPEED INDICATION BETWEEN 150 CR KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (15) CLOSE pitot vent valve and SLOWLY OPEN static vacuum CR valve and cross-bleed valve. Maintain an airspeed CR indication of approximately 250 knots by using CR cross-bleed valve while increasing altitude to 26,000 CR feet as read on standby altimeter.

CR (16) When system has stabilized CLOSE static vacuum valve CR and record standby altimeter reading.

CR (17) After one minute standby altimeter shall not have CR decreased more than 400 feet.

CR CAUTION: DO NOT EXCEED A RATE OF DESCENT OF 5000 FEET PER CR MINUTE, AND KEEP AIRSPEED INDICATION BETWEEN 150 CR KNOTS MINIMUM AND 400 KNOTS MAXIMUM.

CR (18) OPEN static vent valve and permit altitude to decrease. CR Maintain an airspeed indication of approximately 250 CR knots while decreasing altitude by use of cross-bleed CR valve.

CR (19) Permit altitude to decrease to field elevation by operation of static vent valve, then CLOSE valve.

CR (20) Position pitot vent valve OPEN and cross-bleed valve CLOSE.

CR (21) SLOWLY OPEN static vacuum valve until standby altimeter indicates 300 feet above field elevation.

CR (22) When system has stabilized CLOSE static vacuum valve.

CR (23) Remove seal from S1 static orifice on upper right probe. Observe that standby altimeter decreases to field elevation.

CR (24) Remove adapter from lower left probe and remove tape from pitot drain hole.

CR CAUTION: FAILURE TO REMOVE TAPE AND ASSURE THAT STATIC ORIFICES ARE OPEN AND CLEAR CAN RESULT IN INACCURATE READINGS ON THE INSTRUMENTS ASSOCIATED WITH THIS SYSTEM.

CR E. Deleted

CR F. Pneumatic Instruments Functional Test

CR WARNING: NO LUBRICANT OTHER THAN CLEAN WATER OR ALCOHOL IS TO BE USED WHEN INSTALLING ANY PITOT-STATIC PROBE ADAPTER.

CR CAUTION: PITOT-STATIC PROBE HEATERS MUST NOT BE ACTIVATED UNDER ANY CIRCUMSTANCES WHILE PERFORMING THE FOLLOWING TEST. PLACE DO NOT OPERATE SIGNS ON PROBE HEATER SWITCH LIGHTS (REF. 30-31-00).

CR CAUTION: PITOT-STATIC PROBES ARE DELICATE INSTRUMENTS AND CRITICALLY ALIGNED ON THE AIRCRAFT. EXTREME CARE MUST BE EXERCISED WHEN INSTALLING, REMOVING OR HANDLING. TO PREVENT PROBE MISALIGNMENT, TEST HOSES AND ADAPTERS MUST BE SUPPORTED IN SUCH A WAY AS TO ADD NO EXTRA WEIGHT ON PROBES.

CR CAUTION: DO NOT EXCEED 4000 FPM RATE-OF-CLIMB OR DESCENT. DO NOT EXCEED 30,000 FEET ALTITUDE.

CR (1) Install pitot/static adapter PSS55711 on lower left probe.

CR (2) Using electricians tape, seal pitot water drain hole on probe.

CR NOTE: Drain hole is located on bottom aft side of probe.

CR (3) Connect pitot (pressure) source of test unit to pitot fitting on adapter (forward connection on adapter).

CR (4) Connect static (vacuum) source of test unit to S1 connection on adapter (center connection on adapter).

CR (5) Seal S1 static orifices on upper right probe using electricians tape (TWA StK Nbr 41-2251 or 41-2252) or a second pitot/static probe adapter.

CR NOTE: Apply tape so only the S1 static orifices are covered, or if an adapter is being used remove cap on S2 port.

CR (6) Set standby altimeter baro scale so altimeter reads field elevation.

CR (7) Close pitot and static vent valves.

CR (8) Set altitude and airspeed to the values shown in Table 502. Verify indicator readings.

CR (9) Set altitude to field level and airspeed to 50 knots.

CR (10) When field conditions are reached close all valves, set POWER switch to OFF, and remove all test equipment.

CR (11) Perform Paragraph 4G.

CR Pneumatic Instruments Test Functions
CR Table 502

INPUT CONDITIONS		INDICATOR READINGS	
ALTITUDE SETTING (Feet)	AIRSPEED SETTING (Knots)	STANDBY ALTITUDE (Feet)	STANDBY AIRSPEED (Knots)
Field Alt.	160	Field ±50	152 to 168
20,000	370	19,820 to 20,180	358 to 382
30,000	300	29,770 to 30,230	288 to 312

CR G. Restore airplane to normal

CR (1) Remove all seals and adapters from all pitot-static probes. Check that no deposits or roughness exists in or about static ports or pitot head apertures.

CR CAUTION: TO PREVENT PITOT-STATIC PROBE DAMAGE, VISUALLY CHECK EACH PROBE AND VERIFY NO PIECES OF TAPE, COLORED OR TRANSPARENT REMAIN ON PROBE.

CR (2) Remove DO NOT OPERATE signs from probe heat switch lights. ENSURE CIRCUIT BREAKERS FLAP LOAD RELIEF CHAN 1 (H12) AND FLAP LOAD RELIEF CHAN 2 (H20) on FE/SO OVERHEAD CIRCUIT BREAKER PANEL CB2 ARE OPEN.

CR CAUTION: REMOVE "RAT" GROUND SAFETY LOCK (REF. 29-21-00).

CR (3) Re-engage RAT MAN DEPLOY (B14) and RAT AUTO DEPLOY (L3) circuit breakers on pilots overhead circuit breaker panel, CB1.

COMPENSATED PITOT-STATIC PROBE REMOVAL AND INSTALLATION

1. Equipment and Materials

Soft clean cloths

Plastic scraper

Gloves, disposable, MIL-G-36281, or equivalent

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

Environmental seal, non-conductive aluminum colored polysulfide sealant (LAC Spec C-40-1279), or equivalent

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag ANTI-ICE PITOT HEAT circuit breakers F/O SEC (E16), F/O PRIM (E17), and CAPT SEC (E18).

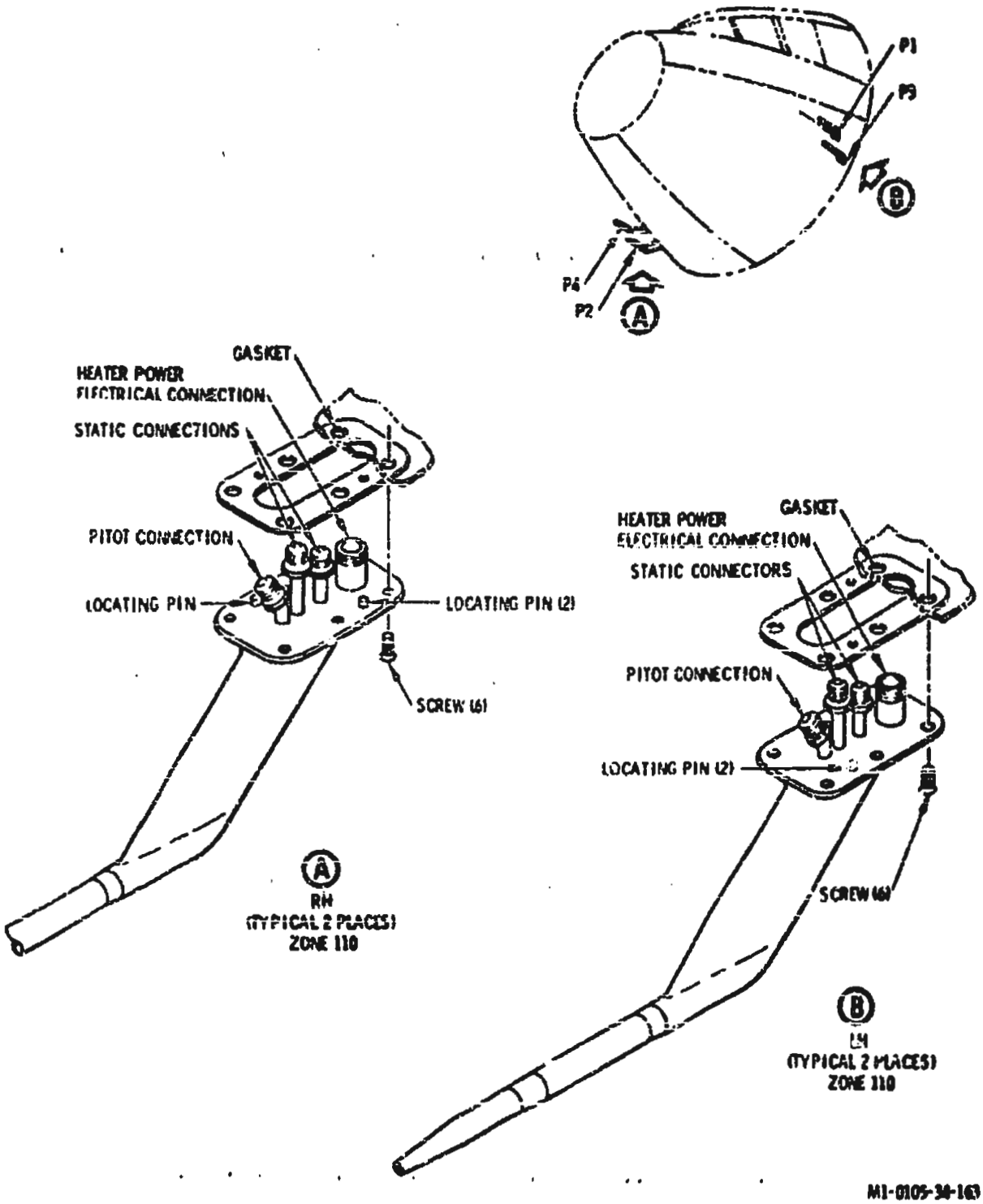
(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag CAPT PRI PITOT HEAT (H14) circuit breaker.

R (3) Locate four pitot-static probes at left and right sides of forward fuselage, FS 222 and FS 230 (Ref. Fig. 401)

(4) Remove screws securing pitot-static probe to fuselage.

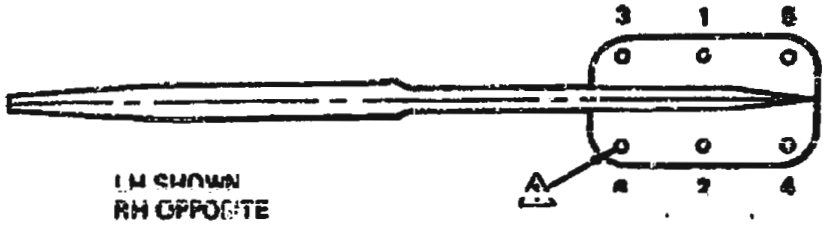
R CAUTION: USE TWO WRENCHES TO DISCONNECT RESISTOFLEX LINES FROM PITOT-STATIC PROBE. HOLD PITOT-STATIC PROBE FITTING WITH ONE WRENCH AND LOOSEN FITTING ON RESISTOFLEX LINE WITH OTHER WRENCH.

(5) Pull pitot-static probe out far enough to disconnect resistoflex lines and electrical connector on pitot-static probe. Remove pitot-static probe.



R Compensated Pitot-Static Probe - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL



PITOT STATIC PROBE

PITOT STATIC PROBE MTG REQUIREMENTS

⚠1 TIGHTEN MOUNTING SCREWS TO 60–65 IN. LBS IN SEQUENCE INDICATED, 1 THRU 8

2 USE TWO WRENCHES TO CONNECT HOSES TO PITOT STATIC PROBES. HOLD PROBE FITTING WITH ONE WRENCH AND TIGHTEN FITTING ON HOSE WITH OTHER WRENCH. TIGHTEN 1/4 TUBE SIZE (–4) FITTINGS TO 144 ±24 IN. LBS, 3/8 SIZE (–6) TO 240 ±60 IN. LBS AND 1/2 SIZE (–8) TO 420 ±60 IN. LBS

3 PITOT STATIC PROBES ARE DELICATE INSTRUMENTS AND CRITICALLY ALIGNED ON THE AIRCRAFT. EXTREME CARE MUST BE USED WHEN HANDLING. TEST HOSES AND ADAPTERS MUST BE SUPPORTED TO ADD NO EXTRA WEIGHT ON PROBES. DO NOT USE LUBRICANTS, OTHER THAN CLEAN WATER, OR FORCE TO INSTALL ADAPTERS

M1-0100-34-003

R Compensated Pitot-Static Probe - Removal and Installation
R Figure 401 (Sheet 2)

R WARNING: KEEP METHYL-ETHYL-KETONE AWAY FROM HEAT, SPARKS AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

USE METHYL-ETHYL-KETONE IN WELL-VENTILATED AREA. AVIOD FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(6) Using plastic scraper, remove sealant from fuselage
R structure. Using soft clean cloth moistened with
R methyl-ethyl-keytone solvent, wipe fuselage structure clean.

B. Installation

(1) Verify that circuit breakers opened in Steps A(1) and A(2) are open and tagged.

R CAUTION: EVEN THOUGH PITOT-STATIC PROBE MOUNTS HAVE
R LOCATING PINS; DUE TO GASKET THICKNESS, IT IS
R POSSIBLE TO INSTALL LEFT PROBE ON RIGHT SIDE AND VICE-VERSE. ENSURE LOCATING PINS ON PROBE TO BE INSTALLED, AGREE WITH HOLES IN FUSELAGE AND GASKET.

C (2) Inspect gasket for damage, replace if necessary.

CR (3) If probe removed had caps installed on one or more tube
C connections, remove and install in same position on new
C probe.

R CAUTION: USE TWO WRENCHES TO CONNECT RESISTOFLEX LINES TO PITOT-STATIC PROBE. HOLD PITOT-STATIC TUBE FITTING WITH ONE WRENCH AND TIGHTEN FITTING ON RESISTOFLEX LINE WITH OTHER WRENCH.

R (4) Position pitot-static probe and reconnect resistoflex lines. Torque resistoflex line fittings as follows:

1/4-inch tubing connection (pitot) to 144 ±24 in lbs.

3/8-inch tubing connection forward static to 240 ±60 in lbs.

1/2-inch tubing connection aft static to 420 ±60 in lbs.

(5) Connect electrical connector to pitot-static probe receptacle.

R WARNING: USE TRICHLORETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

(6) Using clean soft cloth moistened with trichloroethane solvent, clean faying surfaces of fuselage skin cavities, (upper probes) or adapter plates (lower probes), and pitot-static probe mounting plate. Before solvent dries, wipe dry with clean rag.

(7) Position pitot-static probe aligning holes on mounting plate with holes in gasket and fuselage skin cavities (upper probes) or adapter plates (lowerprobes).

(8) Install and tighten screws securing pitot-static probe to fuselage. Torque mounting screws to 60-65 in. lbs. in sequence indicated on Figure 401, Sheet 2.

R WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(9) Wearing gloves, apply a continuous sealant fillet between pitot-static tube mounting plate and fuselage using Environmental Sealant, non-conductive aluminum colored polysulfide sealant (LAC Spec C-40-1279) or equivalent.

C (10) Perform pitot and/or static leak check procedure per C following list.

C (a) Upper left probe, leak check pitot and static C system No. 1.

C (b) Lower left probe, leak check pitot and static C systems No. 3, and static system No. 4.

C (c) Upper right probe, leak check pitot and static C systems No. 4 and static system No. 3.

C (d) Lower right probe, leak check static system No. 1.

(11) Close and secure access door 112AB.

(12) Remove tags and close circuit breakers opened in Step A(1) and A(2).

C

PITOT-STATIC PROBE - INSPECTION/CHECK

C 1. General

C Listed below are damage limits to the pitot-static probes. Any
C damage exceeding these limits is cause for replacement of probe.
C Refer to 34-13-01 Removal/Installation.

C 2. Inspection/Check

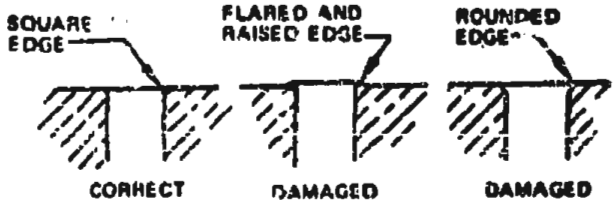
C A. Visually examine pitot-static probe for physical damage or
C foreign material in static ports, drain holes, pitot
C openings, or machined contour (Ref. Fig. 601).

C B. Check that static orifices remain square and sharp.
C Orifices must never be rounded or flared.

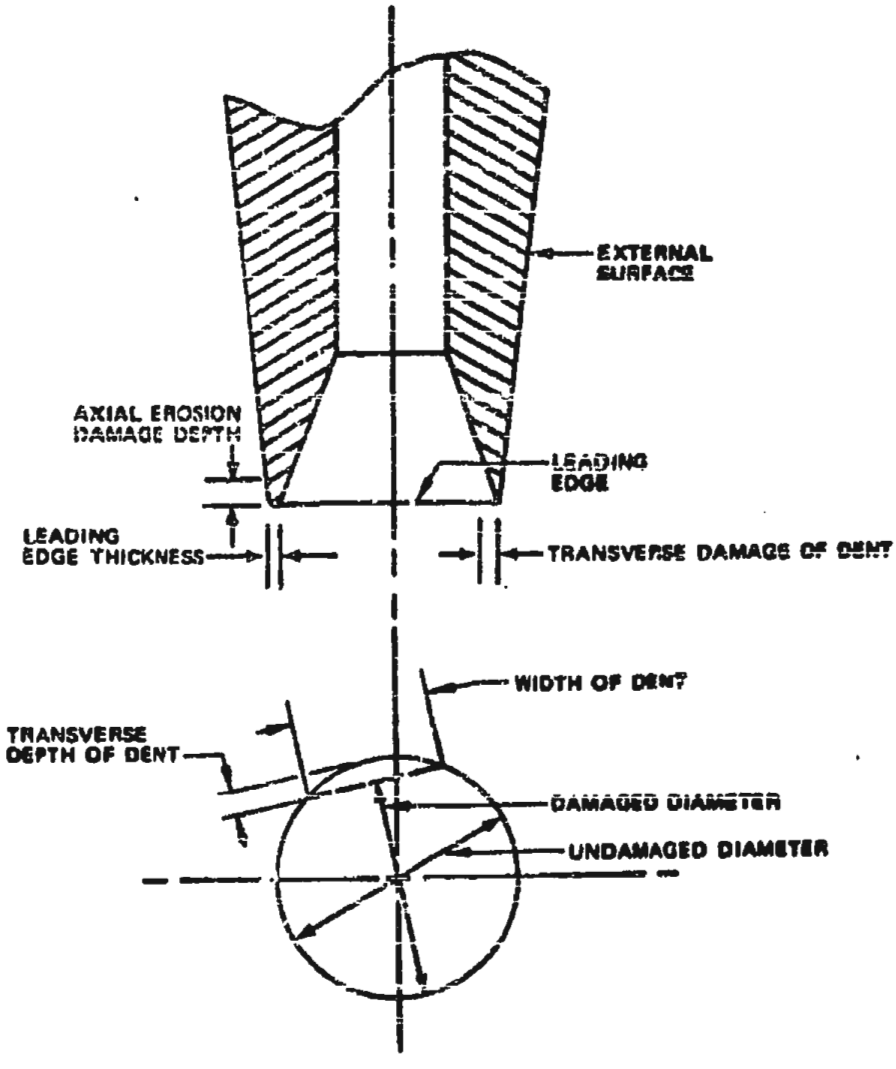
C C. Check that machined surface of pitot-static probes remain
C free of bends or dents. Nicks and scratches smaller than
C 1/32 inch generally do not affect pressure readings,
C provided that deformity is more than 1/2 inch ahead of
C static orifices and 1/4 inch from side of static orifices.

C D. Check that outer surface of probe tip is smooth. Tip must
C not be curled or flared outward. Localized burrs are
C permitted.

C E. Check that localized probe tip transverse dents do not
C exceed 0.030 inch deep and 0.19 inch wide by measuring
C diameter across damaged tip area and comparing with diameter
C of an undamaged area and by measuring dent width.



INSPECTION CRITERIA FOR STATIC PORTS



INSPECTION CRITERIA FOR PROBE TIP

HA 2315
M1401D34B33

C Pitot-Static Probe Tip and Static Port Inspection Criteria
C Figure 601

EFFECTIVITY: SIMPLIFIED

PITOT-STATIC PROBE - INSPECTION AND CHECK

1. General

R Listed below are damage limits to pitot-static probes. Any damage exceeding these limits is cause for replacement of probe. Refer to 34-13-01 Removal/Installation.

2. Inspection/Check

A. General Probe Condition

R (1) Visually inspect unit for physical damage to its
R precision contoured surfaces and for foreign material
R in static ports, drain hole, and pitot opening.

R (2) Check for any detectable bending or twisting of head or
R strut section of unit.

B. Aerodynamic Contour Condition

R (1) Check static pressure ports to make sure their edges
R remain perpendicular to units machined contoured surface. Rounded or raised static port edges should not exceed 0.003 inch (Ref. Fig. 601-a).

(2) Check for scratches, nicks, or surface irregularities
R located within 0.5 inch of static ports, and deeper than 0.015 inch.

R (3) Check for defects exceeding 0.025 inch over rest of
R head, and exceeding 0.125-inch on strut section of
R unit.

C. Pitot Tip Condition

R (1) The leading edge lip of pitot opening should be sharp.
R New tubes are sharpened to a 0.008 maximum flat. The
R tube must be removed if lip has been eroded through
R wear, or dented by abuse to the extent that lip has a
R flatness greater than 0.015 inch (Ref. Figure 601-b).

R (2) The outer surface of lip edge must be smooth. It
R cannot be curled or flared outward. Figure 601-c
R illustrates this condition, which can be detected by
R sliding your fingernail along outer surface at tip.
The tube should be removed if this condition exists.

R (3) The lip can have small inward dents which affect
R roundness of pitot opening, as shown in Figure 601-d.
R The tube must be removed if indentation exceeds 0.035
R inch from normal tip diameter. The dent may be at any
R location around opening, but must not affect more than
R 1/5 (20%) of lip circumference. Damage of this type may be repairable. Units that must be removed from service may be returned to Rosemount Inc. for possible repair.

(4) The leading edge lip can have small nicks or chips as shown in Figure 601-e. The tube must be replaced if two of the nicks are between 0.025 and 0.035 inch deep. The tube must also be replaced if any one nick exceeds 0.035 inch deep.

D. External Surface Corrosion

Where it is suspected that external surface corrosion is influencing static source accuracy, the following information
R describes a method by which probes can be visually inspected with word descriptions for evaluation of the effect of corrosion on system accuracy.

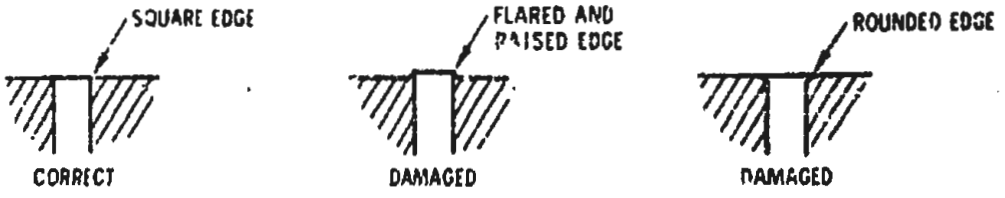
In evaluating each unit, the most critical surface area extends
R from 0.5 inch ahead of S_1 static ports (row closest to pitot
R tip) to 0.5 inch aft of S_2 static ports (row furthest from pitot
R tip). This area is defined as Zones C and D on Figure 602.
R Corrosion occurring entirely on rear barrel starting 0.5 inches
R aft of S_2 ports (Zone E) and corrosion near pitot tip (Zone A)
R will have a smaller influence on static pressure. The Zone A
R area near tip generally remains clear of corrosion.

For use in surface condition inspection, a seven category rating method is listed on Figure 602. These surface conditions are identified as Condition 1 for the best surface, 2, 3, 4, 4F, 5 and Condition 5F for a very rough surface. The following word
R descriptions illustrates seven surface codes.

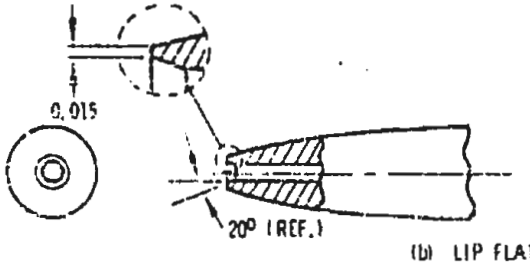
(1) Surface Condition 1: Surface condition is clean and smooth. The surface may be shiny or have a dull finish due to normal electrical heater operation. Localized discolorations and stains may also occur.

(2) Surface Condition 2: Surface is noticeably blackened, but has a velvet finish that is smooth to the touch. Blackening may be uniform over tube or localized at
R certain areas of tube.

(3) Surface Condition 3: Surface shows slight black corrosion and some surface roughening similar to light

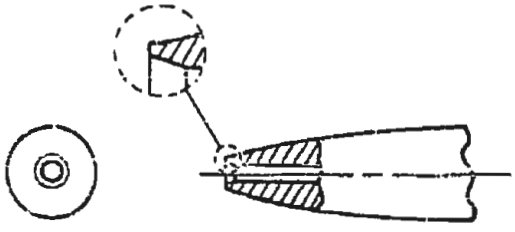


(a) INSPECTION CRITERIA FOR STATIC PRESSURE PORTS



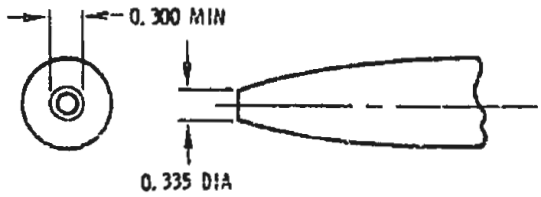
REJECTION CRITERION:
LIP FLATNESS GREATER THAN 0.015 INCH. (APPLIES TO ENTIRE TIP ON THE 856CR7 AND 8, AND APPLIES ONLY TO THE MOST FORWARD PROJECTION OF THE SCARFED TIP ON THE 856CR9 AND 10)

(b) LIP FLATNESS



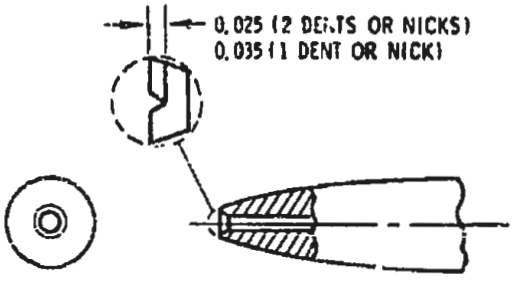
REJECTION CRITERION:
DETECTABLE OUTWARD FLARE OR CURL OF LIP

(c) OUTWARD FLARE OF LIP



REJECTION CRITERIA:
1 INDENTATION EXCEEDING 0.035 INCH OF NORMAL TIP DIAMETER
2 INDENTATION AFFECTING MORE THAN 20% OF TIP CIRCUMFERENCE

(d) INDENTATION OF PITOT OPENING



REJECTION CRITERIA:
1 ANY SINGLE NICK EXCEEDING 0.035 INCH DEEP
2 TWO NICKS BETWEEN 0.025 AND 0.035 INCH DEEP

(e) CHIPS OR NICKS IN PROBE TIP

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Pitot-Static Probe Tip and Static Port Inspection Criteria
Figure 601

sandblasting. Corrosion is more likely to occur on top surface of tube as mounted on aircraft.

(4) Surface Condition 4: Medium surface roughening has occurred, but roughening is uniform especially in static port area. The surface has an appearance similar to medium sandblasting.

(5) Surface Condition 4F: Surface condition is identical to Category 4 except some flaking of roughened surface has occurred forming pits and localized surface irregularities along tube.

(6) Surface Condition 5: With extended useage, a condition of heavy roughening without flaking could occur. It would have the appearance of very heavy sandblasting or heavily rusted metal. It is not known how long it would take to reach this condition, but static pressure errors could become noticeable if this condition is present over static port area.

(7) Surface Condition 5F: Same surface finish as Condition 5 except flaking of surface scale would have occurred resulting in pits and localized surface irregularities. If the 5F condition occurs over static port area, static pressure errors could become noticeable and unit should be removed from aircraft.

E. Correlation Between Surface Roughness and Static Pressure Error

The vendor has conducted an aerodynamic inspection on returned, corroded pitot-static tubes. Measurements were made on both S_1 and S_2 static pressure outputs. Examples of altitude errors were obtained for various types and degrees of corrosion. A precision correlation between surface corrosion and static pressure error is difficult since results generally fall over a range of error. Based on experimental results, Table 601 has been constructed and is believed typical of the maximum influence of corrosion on static pressure output. The average error value in each grouping is approximately 50% of values listed. The range of error occurring on an actual aircraft would normally be less than values indicated, since static pressure output from two tubes are manifolded (left and right sides). If an erroneous tube were coupled with the zero error tube, the actual error range would be one-half the values shown.

Typical Maximum Influence on Static Pressure Output for Model 856CR Pitot-Static Tubes with Sufficient Inflight Service to Produce Corrosion**
Table 601

CORROSION CODE	ERROR RANGE (DELTA P/QC)	ERROR RANGE (FT) AT CRUISE* M - 0.85 AND 35,000 FT	ERROR RANGE (FT) AT APPROACH* M - 0.3 & SEA LEVEL
(1)	±0.002	±25'	±4'
(2)	±0.004	±50'	±7'
(3)	±0.005	±60'	±9'
(4)	±0.006	±80'	±11'
(4F)	±0.007	±90'	±12'
(5)	No Data Available	-----	-----
(5F)	No Data Available	-----	-----

*Typical conditions.
** The range of error occurring on an actual aircraft would normally be less than the values indicated, since static pressure output from two tubes are manifolded (left and right sides). If an erroneous tube were coupled with the zero error tube, the actual error range would be one-half the values shown.

NOTE: No repairs can be accomplished by operator that would improve longevity of pitot-static tubes. In fact, operators are discouraged against attempting repairs since they may do more harm than good to the units. Do not attempt to sand or sandblast an eroded or corroded surface. Do not attempt to clean or refurbish static ports.

A periodic inspection of pitot-static probes for surface and part condition is encouraged. Unless there are flight operational indications, such as altitude or airspeed comparison warnings not tracable to air data computer or instrument failures, general removal of probes due to corrosion or erosion is not necessary. If corrosion or erosion is so bad that removal is considered warranted, the unit should be returned to the vendor (Rosemount) for

R inspection and evaluation. They will provide calibration service for parts and return documentation of test results.

C 3. Pitot/Static Probe Alignment Check

C A. General

C The pitot/static probes are delicate instruments and have
C been critically aligned on the aircraft. Any type of probe
C damage that may cause even slight misalignment will cause
C errors in altimeter and airspeed indicator readings. The
C following procedure outlines the method of checking probe
C alignment on the aircraft.

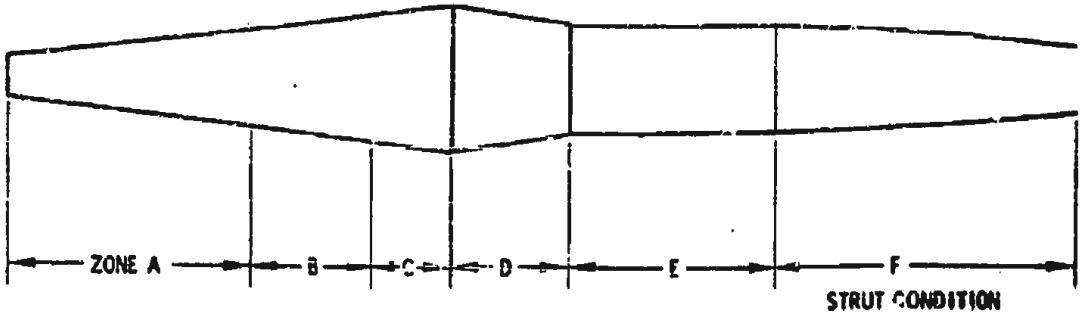
C B. Alignment Check

C (1) Equipment and materials

C (a) Inclinometer TB 108-1 R&R 90205

C (2) Probe mounting tolerances

C (a) Both upper probes should be mounted at 8 degrees
C plus or minus 30 minutes nose down.



SURFACE CONDITION CODES

1	CLEAN - NO CORROSION
2	SURFACE BLACKENING WITH VELVET FINISH
3	LIGHT ROUGHENING
4	MEDIUM ROUGHENING - NO FLAKING
4F	MEDIUM ROUGHENING - SOME FLAKING
5	HEAVY ROUGHENING - NO FLAKING
5F	HEAVY ROUGHENING - SOME FLAKING

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Pitot-Static Tube Surface Condition Evaluation
Figure 602

(b) Both lower probes should be mounted at 5 degrees 30 minutes plus or minus 30 minutes nose down.

(c) The maximum mounting error between the captain's and F/O's systems is 30 minutes.

NOTE: A one degree mounting error between systems will cause approximately a 100 feet altimeter spread in cruise.

(3) Measurement method

(a) Measure aircraft attitude at floor beams in hydraulic service center with inclinometer. Record reading in degrees and minutes nose up or nose down.

(b) Position inclinometer on probe as shown in Figure 602, record reading in degrees and minutes.

(4) Compute probe angle

(a) Subtract 26 minutes from probe angle recorded in Step (3)(b). This is the correction due to shape of the probe.

(b) To correct for aircraft attitude, add reading recorded in Step (3)(a) if nose up or subtract if nose down.

(5) Compute system differences

(a) To aid in computing system differences, a probe alignment error from nominal in a nose down direction should be considered negative with nose up as positive.

Example: 1.

Captain's upper probe measures 8° 10' nose down. This is 10' more nose down than the nominal 8° = 10'.

Example: 2.

Captain's lower probe measures 5° 20' nose down. This is 10' less nose down than the nominal 5° 30' = +10'.

Example: 3.

C Captain's total system error equals upper
C probe -10' added to lower probe error of +10'
C equals system error of zero.

C (b) To computed system differences subtract captain's
C total system error from F/O's total system error.

C Example: 1.

C Captains's upper probe = 8° 10'.

C Example: 2.

C Captain's lower probe = 5° 46'.

C Example: 3.

C Captain's system error = (-10') + (-16)=26'.

C Example: 4.

C F/O's upper probe = 7° 40'.

C Example: 5.

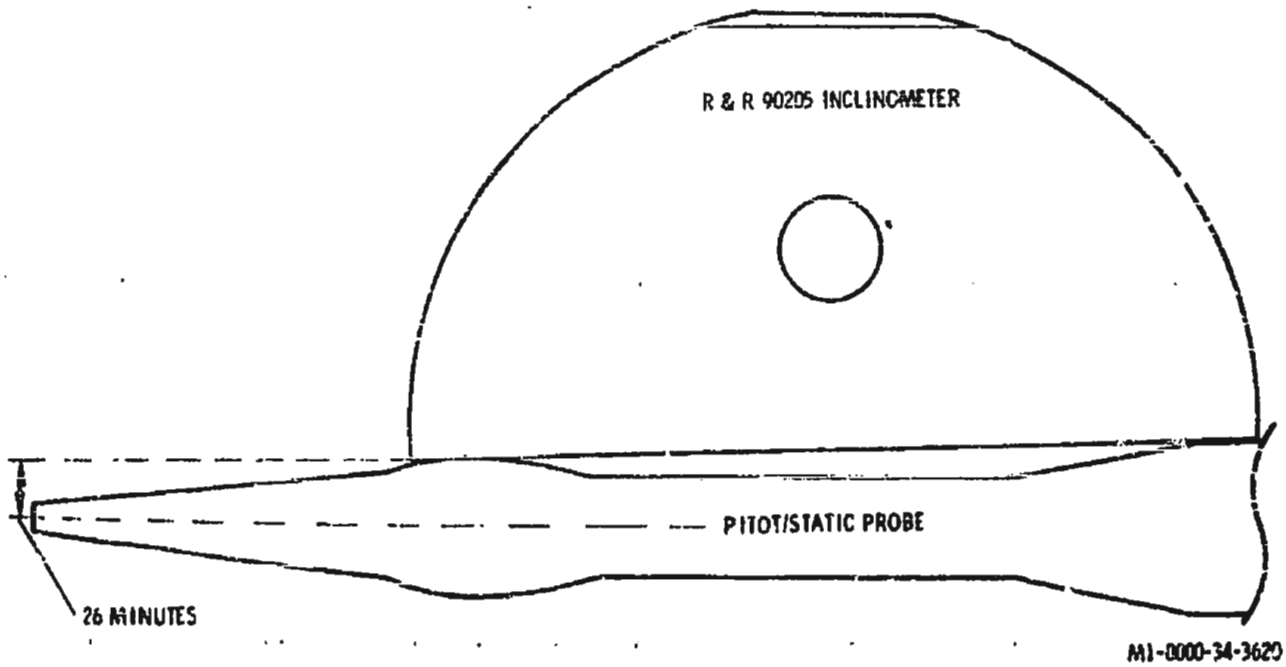
C F/O's lower probe = 5° 36'.

C Example: 6.

C F/O's system error = (+20') + (-6') =+14'.

C Example: 7.

C System difference = (-26') - (+14)=-40'
C difference.



C
C Pitot/Static Probe Alignment Check
Figure 603

R EFFECTIVITY: DETAILED
R
0028

R PITOT-STATIC SYSTEM DRAIN BOTTLE - REMOVAL AND INSTALLATION

R 1. Referenced Procedure

R 34-13-00 Pitot-Static System - Adjustment and Test

R 2. Removal/Installation

R A. Removal

R (1) Open access door 112AB and enter FESC, zone 112.

R (2) Locate drain bottle to be replaced as follows:

R Four bottles are at FS250, LBL 12 (parallel with rear
R edge of access door opening);

R S3 ADC 2 Static Drain

R P4 ADC 2 Pitot Drain

R S1 ADC 1 Pitot Drain

R P1 ADC 1 Pitot Drain

R Two bottles are at FS219, LBL 22;

R S4 F/O Sec Static Drain

R P3 F/O Sec Pitot Drain

R One bottle at FS230, RBL61;

R S4 F/O Sec Static Drain

R (3) Loosen nut and remove screw and washer securing each
R clamp on drain bottle to be removed (Ref. Fig. 401).

R (4) Remove drain bottle from tube assembly.

R B. Installation

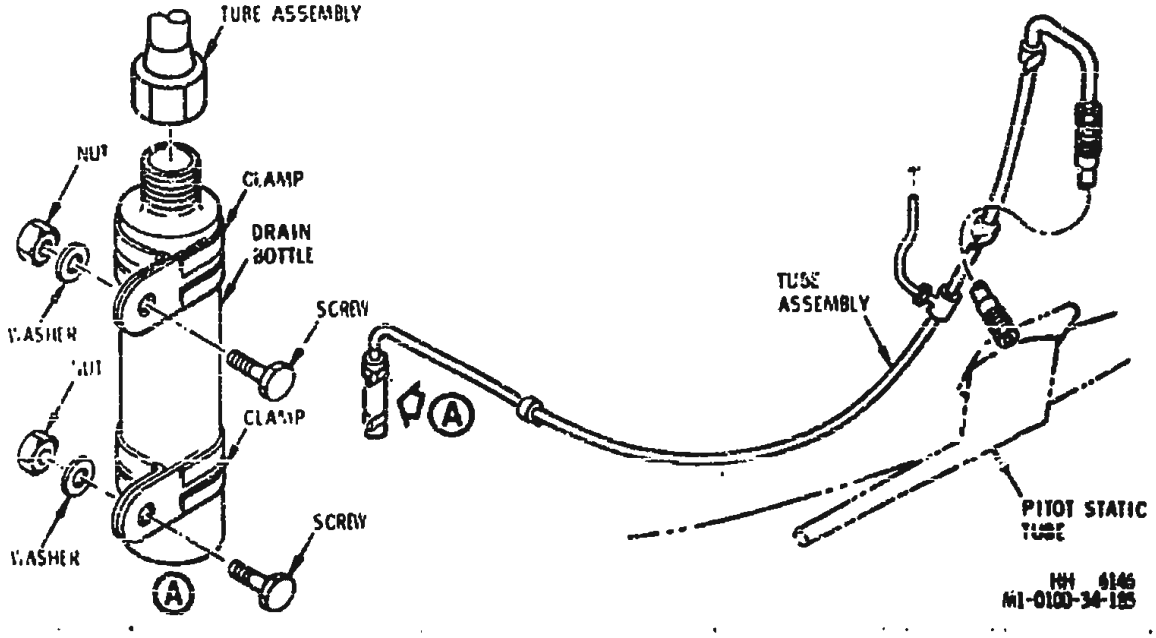
R (1) Install two clamps on replacement drain bottle (Ref.
R Fig. 401).

R (2) Connect drain bottle to tube assembly.

R (3) Install and secure drain bottle with screw, washer and
R nut at each clamp.

(4) Perform pitot and/or static leak check procedure applicable to drain bottle replaced (Ref. 34-13-00).

(5) Close and secure access door 112AB.



Pitot-Static Drain Bottle - Removal and Installation
Figure 401

PITOT-STATIC DRAIN BOTTLES - INSPECTION AND CHECK

1. Referenced Procedures

   34-13-00 Pitot-Static System - Adjustment and Test

2. Equipment and Materials

   NAS 1612-4 O-ring

3. Inspection/Check

   A. Open access door 112AB and enter forward electronic service center, zone 112. Locate pitot-static system drain bottles.

   Bottles are located as follows: Four bottles are at FS250 and LBL12 (parallel with rear edge of access door opening)

   S3 ADC 2 Static drain

   P4 ADC 2 Pitot drain

   S1 ADC 1 Static drain

   P1 ADC 1 Pitot drain

   Two bottles are at FS219 and LBL22

   S4 F/O Sec static drain

   P3 F/O Sec Pitot drain

   One bottle at FS230 and RBL61

   S4 F/O Sec static drain

   B. Check for liquid in drain bottle(s) (yellow balls float to indicate presence of liquid).

   C. If liquid is present, proceed as follows:

   (1) Remove plug and o-ring at bottom of drain bottle and empty liquid into container.

   (2) Inspect O-ring for damage and replace if necessary.

   (3) Install plug and O-ring in bottom of drain bottle.

D. Perform pitot-static leak check on affected system (Ref. 34-13-00).

R R R R NOTE: Looking aft at FS250; the four drain bottles on the right are (inboard to outboard) S3 ADC 2 static drain, P4 ADC 2 pitot drain, S1 ADC 1 static drain, and P1 ADC 1 pitot drain.

E. Close and secure access door 112AB.

STANDBY AIRSPEED INDICATOR (PNEUMATIC) - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-13-00 Pitot-Static System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 5 VAC INSTRUMENT LIGHTING - CTR - L (L22).

      (2) Loosen clamp screws securing standby airspeed indicator to pilots center instrument panel, zone 210, (Ref. Fig. 401).

R CAUTION: DO NOT DISCONNECT DYNATUBE ADAPTERS ON STANDBY AIRSPEED INDICATOR PITOT AND STATIC CONNECTORS.

      (3) Pull standby airspeed indicator out of recess in pilots center instrument panel and break Dynatube fittings, disconnecting pitot and static lines from standby airspeed indicator.

      (4) Disconnect electrical connector and remove standby airspeed indicator.

   B. Installation

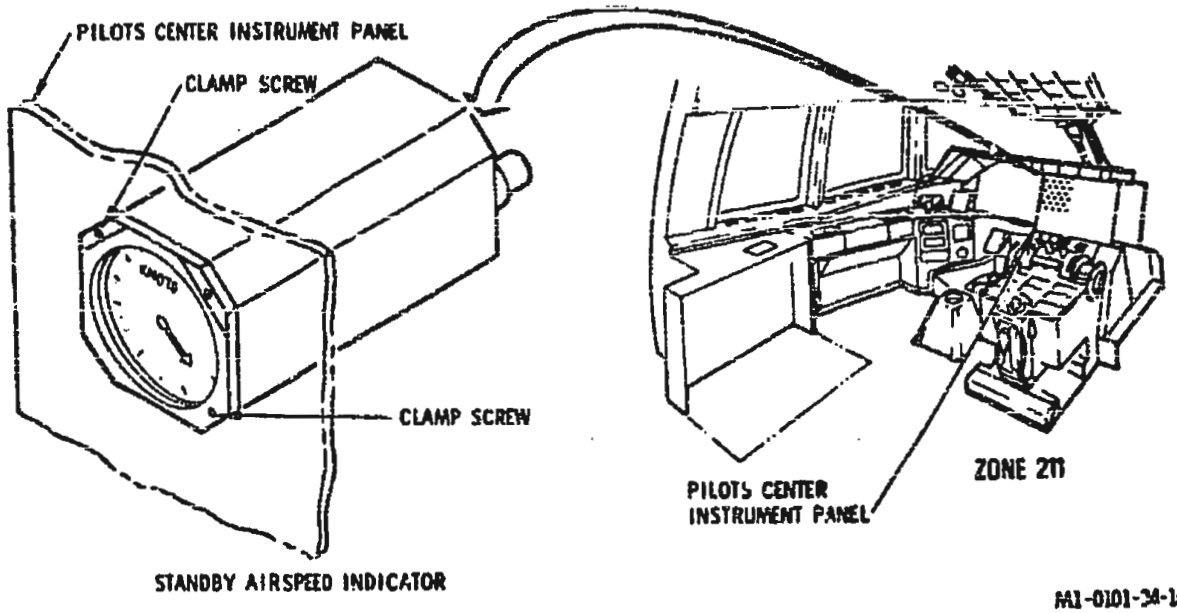
      (1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

      (2) Connect aircraft pitot and static lines and electrical cable to Dynatube adapters and electrical receptacle on rear of standby airspeed indicator.

      (3) Place standby airspeed indicator into recess on pilots center instrument panel, slide into position, and secure by tightening clamp screws.

      (4) Remove tag and close circuit breaker opened in Step A(1).

      (5) Perform pitot-static leak check on secondary pitot-static system (Ref. 34-13-00, Page 501).



R Standby Airspeed Indicator (Pneumatic) - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

STANDBY BAROMETRIC ALTITUDE INDICATOR (PNEUMATIC) REMOVAL AND INSTALLATION

1. Reference Procedure

34-13-00 Pitot-Static System - Adjustment and Test

2. Removal/Installation

A. Removal

R (1) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 5VAC INSTRUMENT LIGHTING CTR L (L22).

(2) Loosen clamp screws securing standby barometric altitude indicator to pilots center instrument panel, zone 210, (Ref. Fig. 401).

CAUTION: DO NOT DISCONNECT DYNATUBE ADAPTER ON STANDBY BAROMETRIC ALTITUDE INDICATOR STATIC CONNECTOR.

(3) Pull standby barometric altitude indicator out of recess in pilots center instrument panel and break Dynatube fitting, disconnecting static line from standby barometric altitude indicator.

(4) Disconnect electrical connector and remove standby barometric altitude indicator.

B. Installation

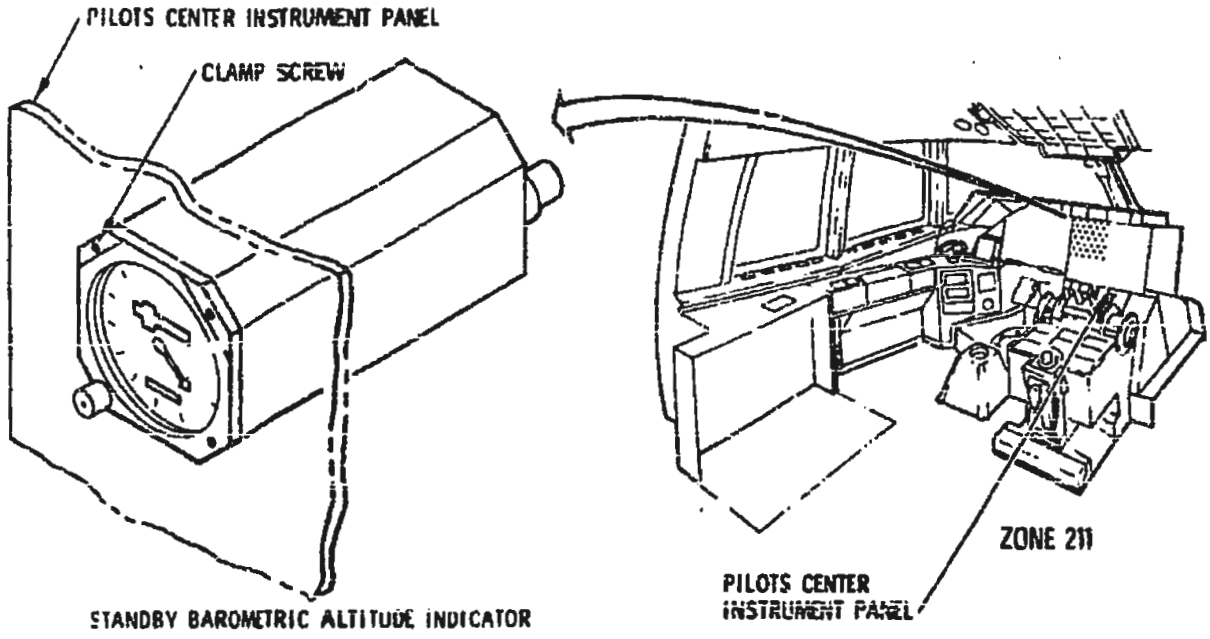
(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Connect aircraft static line and electrical cable to Dynatube adapter and electrical receptacle on rear of standby altitude indicator.

(3) Place standby barometric altimeter into recess on pilots center instrument panel, slide into position, and secure by tightening clamp screws.

(4) Remove tag and close circuit breaker opened in Step 2A(1).

(5) Perform pitot-static leak check on secondary pitot-static system (Ref. 34-13-00, Page 501).



R Standby Barometric Altitude Indicator - Removal and Installation
R Figure 401

ANALOG/DIGITAL AIR DATA COMPUTER SYSTEM - DESCRIPTION AND OPERATION

1. General

The air data computer (ADC) system consists of two systems, each comprised of an ADC, a total air temperature probe, a barometric altitude indicator (servoed), an airspeed/Mach indicator (servoed), and a vertical speed (rate-of-climb) indicator. In addition, system No. 2 supplies true airspeed to a true airspeed (TAS) indicator (servoed) and static air temperature to a static air temperature (SAT) indicator (servoed) (Ref. 34-15-00).

R The ADCs can be a digital or analog type and may be intermixed. However, analog ADCs cannot be used in place of a digital ADC on Dash 500 aircraft.

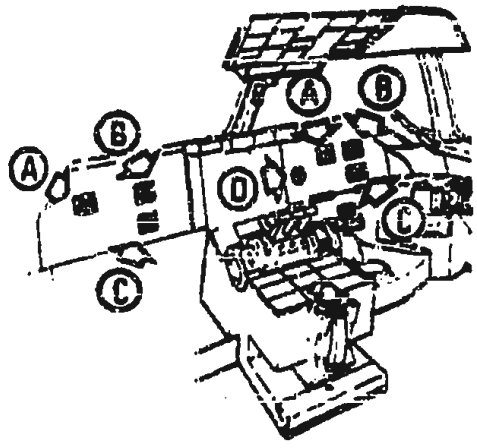
R R Digital ADCs may not appear in your fleet; however, analog ADCs are no longer being manufactured and there is this possibility.

The ADC (Ref. Fig. 1) receives ram and static pressure inputs from the pitot-static system (Ref. 34-13-00) and electrical temperature signals from the total air temperature probes; these inputs are used to generate altitude, vertical speed, airspeed, Mach, true airspeed and static air temperature information. This information is displayed on pilots instruments.

Data valid signals from the ADC (Ref. Fig. 2) are provided for each instrument display. Loss of a data valid signal causes a warning flag to appear on applicable instruments. Internal failure monitors in each instrument also cause warning flags to appear when a malfunction is detected.

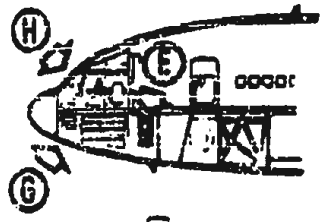
The altitude, vertical speed and airspeed/Mach signals from each ADC are repeated in the corresponding servoed instrument. Altitude and airspeed signals are compared with equivalent signals from instruments of the opposite ADC system. A comparison error is detected in the central instrument warning system (Ref. 34-16-00). Failure of comparison transolver excitation, or a significant difference in signals causes the applicable message to show.

In the event of a failure indication for any altitude, vertical speed, or airspeed/Mach signal, alternate inputs from the opposite ADC can be selected for any of the servoed instruments with the instrument source selector system (Ref. 34-00-01). Lockout circuits in the instrument source selector system prevent selecting ALTN ALT or ALTN AS/M for any two identical instruments simultaneously.



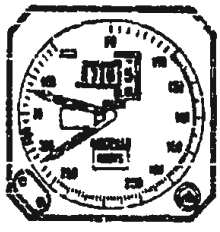
FLIGHT STATION

(H)



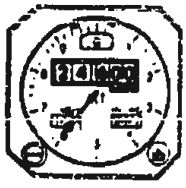
(G)

TOTAL AIR TEMPERATURE SENSOR (2)



(A)

AIRSPEED/MACH INDICATOR (SERVOED)



(B)

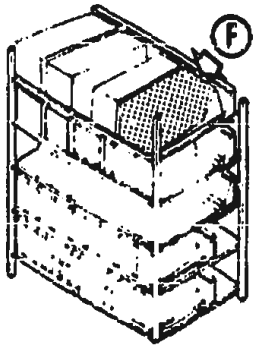
BAROMETRIC ALTITUDE INDICATOR (SERVOED)

(C)

VERTICAL SPEED INDICATOR

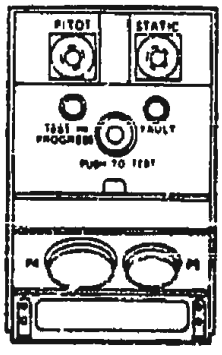
(D)

TRUE AIRSPEED INDICATOR (TAS)



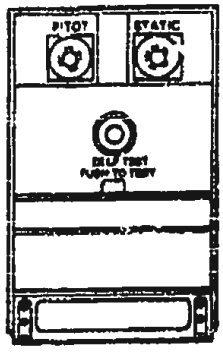
(E)

FORWARD ELECTRONIC SERVICE CENTER REAR RACK NO. 1



(F)

DIGITAL AIR DATA COMPUTER



(F)

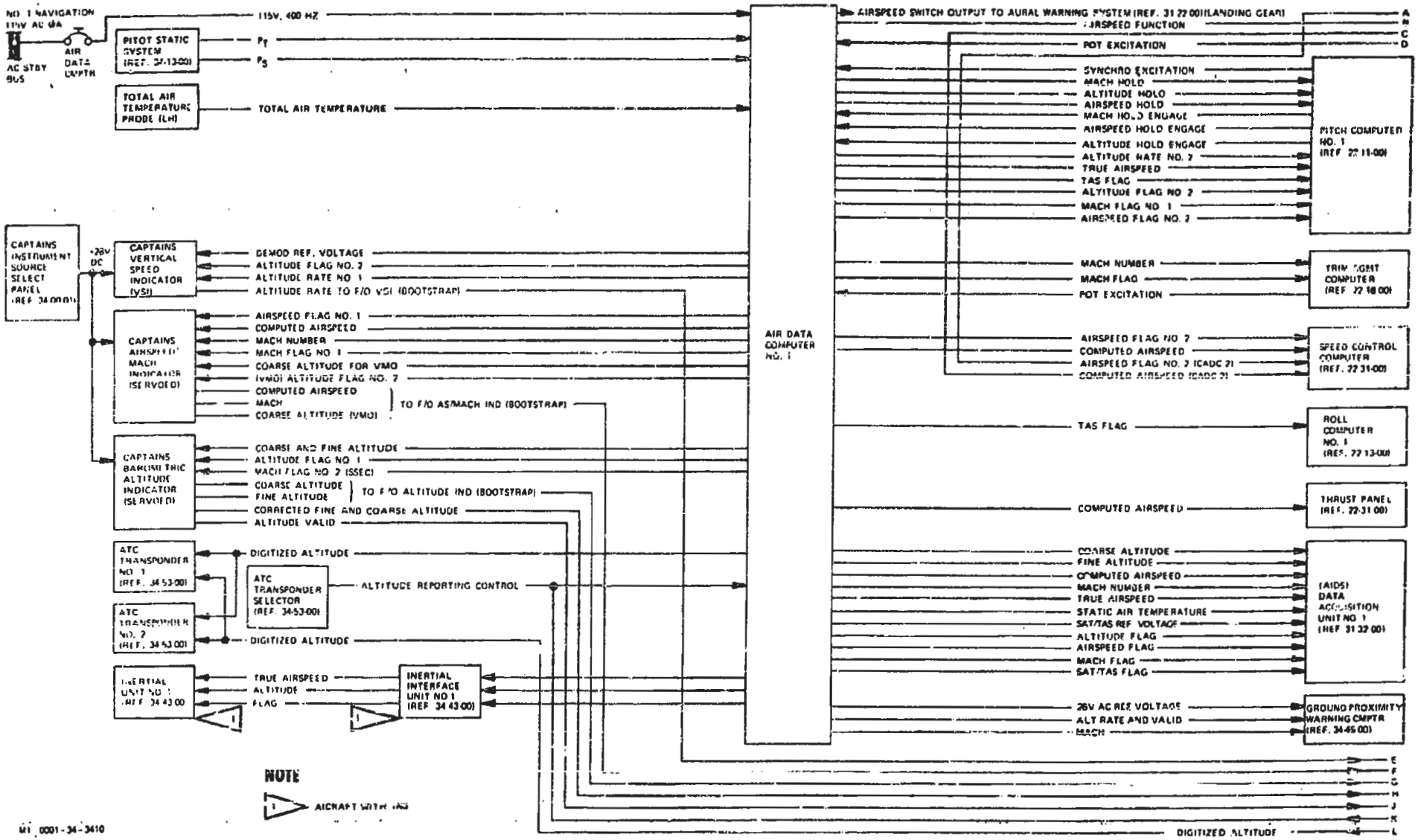
ANALOG AIR DATA COMPUTER

MI-0001-34-3609

R
R

Air Data Computer System
Figure 1

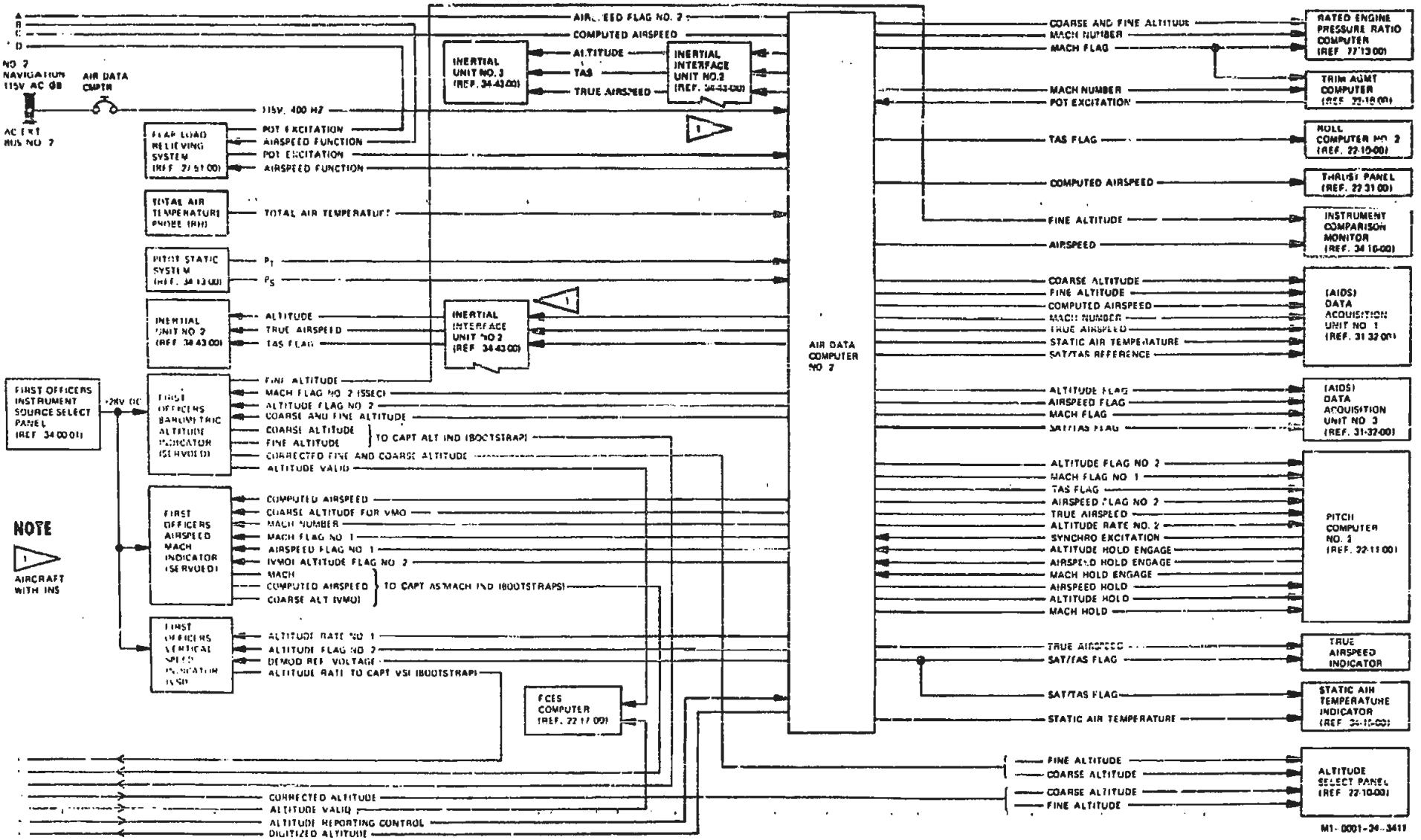
R EFFECTIVITY: ALL
R
001B



R Air Data Computer System Block Diagram
R Figure 2 (Sheet 1)

EFFECTIVITY: ALL

0018



R R Air Data Computer System Block Diagram
Figure 2 (Sheet 2)

EFFECTIVITY: ALL

001B

Outputs from the ADC system are provided to various systems as follows: altitude, airspeed, Mach, and true airspeed to the autoflight system (Ref. 22-00-00) for pitch, roll, automatic speed, altitude, and trim functions; digitized altitude to the ATC transponder system (Ref. 34-53-00) for altitude reporting; barometrically corrected altitude and true airspeed to the inertial navigation system; altitude and Mach to the rated
R engine pressure ratio computer (Ref. 77-13-00); fine and coarse altitude, airspeed, Mach and TAS from ADC No. 1 and 2 to the aircraft integrated data system (Ref. 31-32-00) and fine and coarse altitude to the digital flight data recorder (Ref.
R 31-31-00); to the wing flap control system (Ref. 27-51-00) for flap aerodynamic overload protection (airspeed information); and via the airspeed/Mach indicator to the aural warning system (Ref. 31-22-00) for overspeed warning. An airspeed signal is provided to the instrument comparison monitor (Ref. 34-16-00) for threshold modification of the airspeed comparison channel; an airspeed switch closure actuates circuitry in the proximity warning system (Ref. 33-18-00) for the landing gear warning horn; and via the airspeed/Mach indicator, a switch is provided as part of the ram air turbine (RAT) (29-21-00) lockout circuit to prevent inadvertent extension on the ground.

ADC No. 2 also provides barometric altitude, altitude validity and 26V ac reference signals to the GPWS computer (34-45-00).

2. Operation

The air data computer receives inputs of static pressure, total pressure and total temperature. The ADC utilitizes these inputs to perform its computations and provide electrical outputs of aircraft Mach number, Mach number hold, computed airspeed, computed airspeed hold, pressure altitude, pressure altitude rate (vertical speed), pressure altitude hold, true airspeed, static air temperature, and total air temperature. The various outputs are sent out to the using system. To allow the ADC to be compatible with more than one type of aircraft, static source error correction voltages are used. The static source error correction voltages are generated within the ADC as determined by external jumpers on the equipment rack. This voltage corrects the altitude and airspeed to correct the channels for static source errors for a particular aircraft type and model.

The ADC contains a self test function for system test.

The system indicators are dc-servoed solid-state instruments which display information from the ADC, including measured and calculated air data values and data valid (warning flag) information. Servoed indicators provide a combination of digital and pointer-type displays, with additional plus/minus-type displays for recognition of negative readings.

Some servoed instrument displays are nonlinear, so critical areas may be expanded. Warning flags are marked according to function on multiple-display instruments, since a function can fail without affecting other functions.

3. Instrument Source Selection

A. ALTN AS/M Switchlight

In normal operation, computed airspeed data from ADC-1 and ADC-2 is displayed on the Captains and First Officers airspeed/Mach indicators (Ref. 34-00-01). If the Captains ALTN AS/M switchlight is pressed, relays in the Captains airspeed/Mach indicator are energized. The relay contacts remove computed airspeed data from ADC-1 to the Captains airspeed/Mach indicator which is now supplied from the First Officers Indicator. The ADC-2 computed airspeed data is then displayed on both Captains and First Officers airspeed/Mach indicators. When the First Officers ALTN AS/M switchlight is pressed, operation is similar to the Captains ALTN AS/M switchlight, and computed airspeed data from ADC-1 is displayed on both Captains and First Officers airspeed/Mach indicators. The switchlight also energizes a relay that interrupts 28V dc to the opposite ALTN AS/M switchlight, this prevents both Captain and First Officer selecting ALTN AS/M at the same time.

B. ALTN ALT Switchlight

In normal operation, altitude and vertical speed information from ADC-1 and ADC-2 is displayed on Captains and First Officers barometric altitude indicators and VSI. If the Captains ALTN ALT switchlight is pressed, relays are energized in the Captains barometric altitude indicator and VSI. The relay contacts remove altitude and vertical speed information from ADC-1 to the Captains barometric altitude indicator (servoed) and VSI which is now supplied from the First Officers Indicator. The switchlight also energizes a relay that interrupts 28V dc to the opposite ALTN ALT switchlight, this prevents both Captain and First Officer selecting ALTN ALT at the same time.

When the First Officers ALTN ALT switchlight is pressed, operation is identical to the Captains ALTN ALT switchlight, except 28V dc is removed from the Captains ALTN ALT switchlight and altitude and vertical speed information from ADC-1 is displayed on the Captains and First Officers barometric altitude indicators (servoed) and VSI.

4. Analog Air Data Computer (AADC)

A. Description

The AADC (Ref. Fig. 1) is a pneumatic/electrical/mechanical device which converts air pressure and electrical signals into analog electrical outputs representing pressure altitude, airspeed/Mach, vertical speed, true airspeed, and static air temperature. The AADC is housed in a standard 1/2 ATR case. The AADC consists of a chassis assembly including wiring and a plug-in power supply, a logic module, and three plug-in computing modules (the altitude, airspeed, and Mach/TAS/SAT computers). The two AADCs are located on the forward electronic service center rear rack, shelf 5, zone 113. The AADC front panel contains a test connector and SELF TEST switch. The AADC is secured to a mounting rack. All electrical connections are through a three-segment connector at the rear. The AADC is supplied 115V, 400-Hz from the aircraft bus system for operation.

B. Operation

Altitude Computer Module

Static air pressure from the pitot-static system acts on a pressure sensor (Ref. Fig. 3). A change in pressure unbalances an E-pickoff error detector, causing an error signal to be detected, amplified, and applied to the altitude loop servomotor. The servomotor drives a gear train and a pressure function cam. A cam follower causes a torsion bar to turn to rebalance the E-pickoff. The servomotor also drives the altitude analog shaft to position output potentiometers and synchro transmitters, which provide electrical analog signals representing pressure altitude. A tachometer-generator on the servomotor shaft provides damping in the servo loop. Its output, which is a function of vertical speed (altitude rate), is used as a computer output (vertical speed). A static source error correction voltage is also applied to the servo loop summation network as a function of Mach number and pressure altitude.

Airspeed Computer Module

The airspeed computer module is similar to the altitude computer module, however, instead of measuring a single pressure level the sensor measures the difference between static and ram air pressures. A change in either pressure unbalances the E-pickoff and causes the servo loop to restore it to equilibrium. A static source error correction signal is applied to the servo

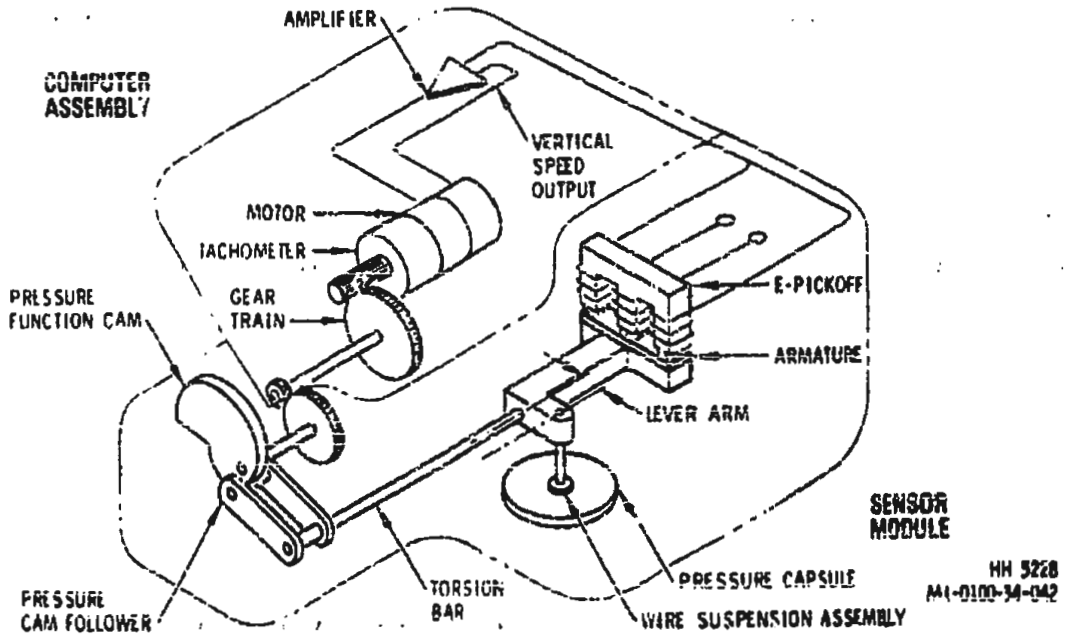
loop summation network as a function of Mach number and pressure altitude.

Mach/TAS/SAT Computer Module

The Mach/TAS/SAT module is an electromechanical unit; no pneumatic signals are applied to this module. Electrical inputs from the airspeed computer and the total air temperature probe are used to provide several outputs. Mach number is generated as a function of airspeed and altitude. This function is generated in the airspeed computer by exciting a potentiometer on the airspeed analog shaft with pressure altitude information. This is a function of Mach number, and is provided to the Mach servo loop as the primary input. The output of the Mach number shaft positions potentiometers and synchro transmitters providing electrical analog signals representing Mach number.

True airspeed and static air temperature are computed as functions of Mach number and total air temperature. The total air temperature signal is used to excite potentiometers on the Mach analog shaft, and the wiper outputs are functions of the desired quantities.

Chassis Assembly



AADC Force-balance Sensor Schematic
Figure 3

The chassis assembly includes a front panel self-test pushbutton, a plug-in power supply, and three computer modules. Plug-in pneumatic and electrical connections to the computer modules are provided, as well as chassis wiring, by rear panel connectors and a front panel test connector for test equipment.

5. Digital Air Data Computer

A. Description

The digital air data computer (DADC) (Ref. Fig. 4) is a state-of-the-art digital system employing a preprogrammed microprocessor for computations and control. It converts air pressure and electrical signals into digital and analog electrical outputs representing pressure altitude, airspeed/Mach, vertical speed, true airspeed, and static air temperature. The ADC is housed in a standard 1/2 ATR case. The two DADCs are located on the forward electronic service center rear rack, shelf 5, zone 113. The DADC front panel contains two test connectors and a SELF TEST switch. The DADC is secured to a mounting rack and all electrical connections are through a three-segment connector at the rear. The DADC is supplied 115V, 400 Hz from the aircraft bus system for operation.

B. Operation

The DADC receives analog and discrete signals for operation.

The primary inputs to the DADC are total air temperature (TAT), pitot and static pressure. These signals are converted to analog in the pitot and static sensors and supplied to the analog multiplexer.

The analog multiplexer puts the data in serial format and supplies it to the analog to digital (A/D) converter.

The A/D converter converts the analog to digital formatted serial data. This data, along with data from the discrete data register and BIT card, is supplied to the digital multiplexer.

The signals are then multiplexed to the microprocessor for generation of air data signals. These signals are supplied to four output stages: D/A converter, data bus buffer, potentiometers and flag drivers. These four stages condition the signals for user equipment interface.

The BIT card collects and conditions numerous internal signals that are routed, via the digital multiplexer, to the

microprocessor. The microprocessor checks them for proper operation of the DADC.

The power supply receives 115 VAC from aircraft power and develops all voltages used in the DADC, and supplies 26 Vac, 11.8 Vac and 20 Vac for external use.

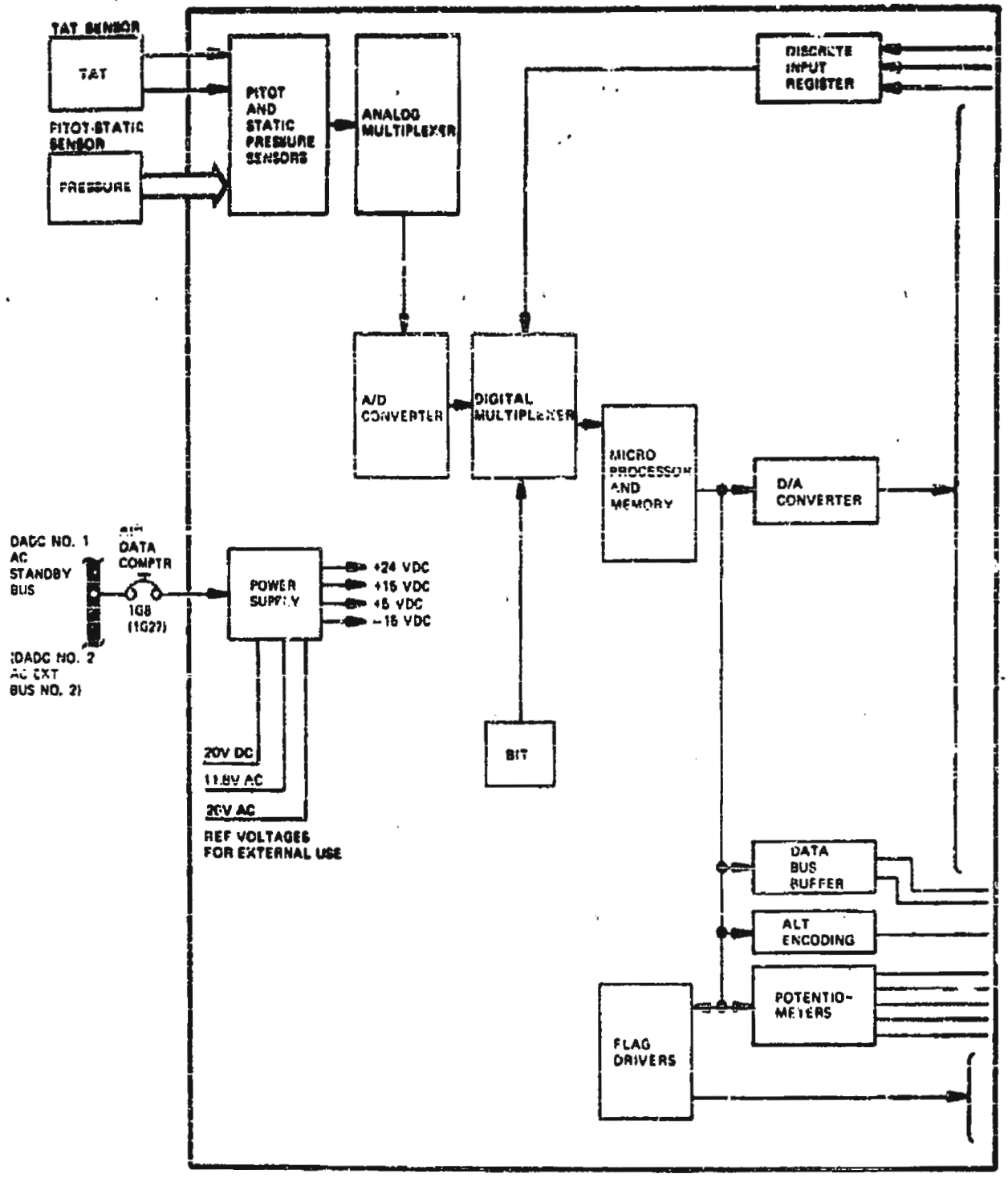
6. Barometric Altitude Indicator

A. Description

The indicators (Ref. Fig. 5) are solid-state, dc-servoed instruments, which display barometric altitude information from the air data computers corrected to local barometric pressure by the pilots. Altitudes between -1,000 and 50,000-feet,, corrected to local barometric pressures in the range of 17.20 to 31.90-inches of mercury (582.5 to 1080.0-millibars) are displayed. The indicators are clamp-mounted, one on the Captains instrument panel, zone 211, and one on the First Officers instrument panel, zone 212. Input data for the Captains indicator is normally provided by ADC No. 1 and data for the First Officers indicator is normally provided by ADC No. 2. The indicators are bootstrapped, ie: either indicator can be switched to the other computer through the opposite indicator, by selecting ALT ALTN on the applicable instrument source select panel (Ref. 34-00-01) . Switching either indicator also causes the corresponding vertical speed indicator to switch to the other computer through the opposite indicator. Integral lighting is provided (Ref. 33-11-00).

The local barometric pressure setting, as adjusted by the pilots, is displayed on parallel counters in units of millibars (MB) and inches of mercury (IN HG). Corrected barometric altitude is displayed on a four-drum counter to four significant figures with the right-hand drum numbered in steps of 20-feet. The 20-foot counter will move in steps at less than 20-feet per second climb or descent. At 60-feet per second climb or descent, the 20-foot counter will move in a smooth motion. Between 20 and 60-feet per second it could be smooth or stepping. There is also a pointer display of altitude between 1000-foot levels. The left (10,000-feet) drum has a green crosshatched black display in place of a zero (0) to alert the pilots to altitudes of less than 10,000- feet. A negative (NEG) altitude shutter-bar obscures the altitude counter display to indicate altitudes below sea level.

A red failure warning OFF flag is controlled by a functionally separate failure monitor circuit. The OFF flag



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Digital Air Data Computer Block Diagram
Figure 4

drops into view obscuring the altitude counter display to indicate a failure due to any of the following:

Absence of primary power

Internal power supply failure

Persistent excessive error signal from coarse or fine altitude transolvers

Absence of three-wire inputs to coarse or fine altitude transolvers

Open circuit in coarse or fine altitude transolver windings

Absence of data valid input signal from the ADC

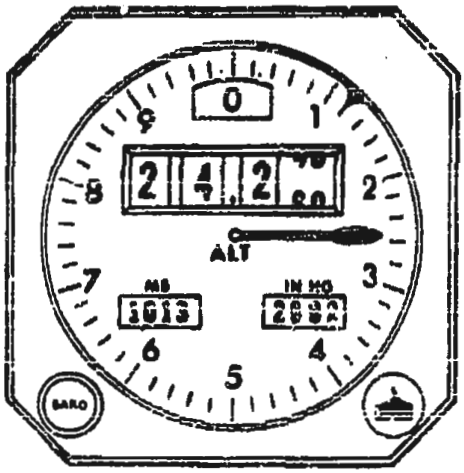
An orange static source error correction (SSC) flag drops into view at the top of the indicator to indicate a failure of the static source error correction mechanism in the ADC. This flag is controlled by a Mach validity signal.

The indicator is provided with a yellow altitude reference marker (bug) with a set knob. As the set knob is rotated, the altitude bug moves around the indicator periphery.

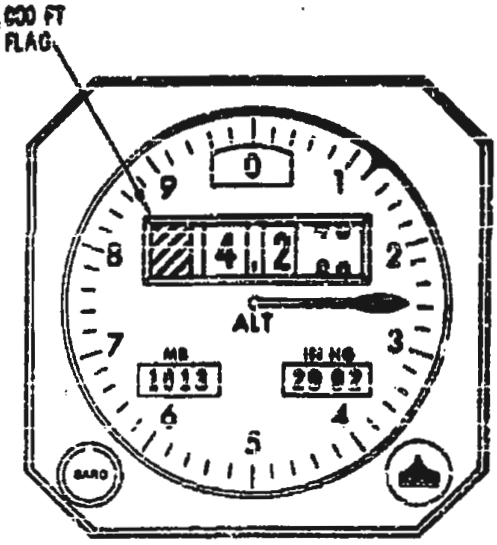
B. Operation

Transolvers in the indicator receive coarse and fine altitude information from the ADC. The level switch selects the coarse altitude error signal to drive the altitude servo loop until the signal drops below a preselected ac switching level, at which time a microcircuit differential comparator causes an analog switch to switch from the coarse to the fine altitude error signal. The error signal is then applied through a servo amplifier to drive the gear trains. Altitude is displayed on a drum counter and a pointer. The gear train also drives both the coarse and fine input transolver rotors to null the servo system.

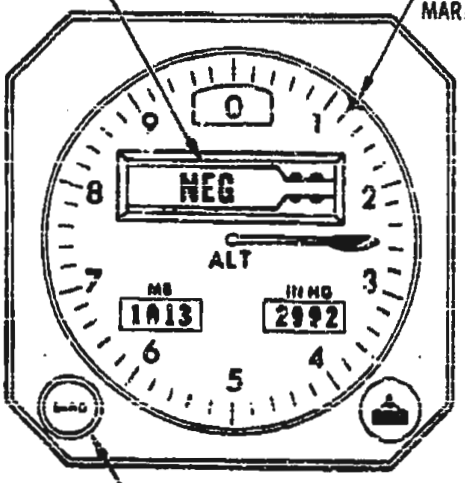
Coarse and fine barometrically corrected altitude synchros in the barometric altitude indicators are excited by 26V ac, 400-Hz. The output from the synchros is applied to a control transformer (CT) and a differential resolver (DR) respectively in the ALTITUDE SELECT panel (Ref. 22-10-00). The CT and DR are then positioned by setting in the desired altitude on the ALTITUDE SELECT panel on the glareshield. An error signal comprised of the synchro outputs (true corrected altitude) and the desired altitude signal set into the CT and DR is then applied to the FCES computer (Ref.



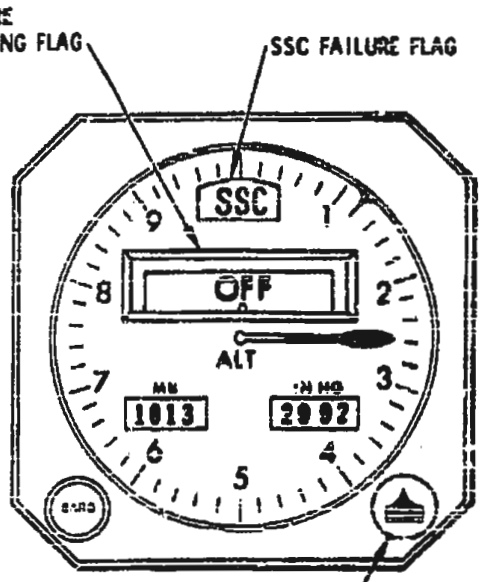
NORMAL INDICATION - ABOVE 10,000 FT



NORMAL INDICATION - BELOW 10,000 FT



NORMAL INDICATION - BELOW SEA LEVEL



FAILED INDICATION - WARNING FLAGS SHOWING

M1-27603-34-274

R Barometric Altitude Indicator
R Figure 5

R EFFECTIVITY: ALL
R
001B

22-17-00) where it is used for altitude alert and altitude capture computations.

Bootstrap coarse and fine altitude transolvers are driven by the altitude servo loop and repeat the input signals from the ADC for transmission to the other indicator so that the indicators can be operated individually from their respective ADC, or together from either ADC. The bootstrap transolvers also provide comparison information to the central instrument warning system (Ref. 34-16-00).

7. Airspeed/Mach Indicator (Servoed)

A. Description

The indicators (Ref. Fig. 6)are solid-state, dc-servoed instruments which display airspeed, Mach and coarse altitude (Vmo) information from the ADC. Included in the displays are: pointer display of computed airspeed, airspeed set bug, pointer display of maximum allowable airspeed (Vmo), counter display of Mach number, and failure annunciator flags for each of the three displays. The indicators are clamp-mounted, one each on the Captains and the First Officers instrument panels, zone 211 and 212. The indicators also provide ove. speed warning (switch closure), ram air turbine interlock switch functions, and data valid signal outputs for external equipment. Input data for Captains and First Officers indicator is normally provided by ADC No. 1 and ADC No. 2. respectively. The indicators are bootstrapped, ie; either indicator can be switched to the other computer through the opposite indicator by selecting AS/M ALTN on applicable instrument source select panel (Ref. 34-00-01). Integral lighting is provided (Ref. 33-11-00).

The indicators have a mechanically selectable Vmo pointer that may be set to 270-knots for limited airspeed conditions such as landing gear down dispatch. Normal setting is 375-knots.

Each of the three display servo loops is provided with a functionally separate failure monitor to control the failure flag display. The flags will drop into view due to any of the following (failures):

Absence of primary power

Internal power supply failure

Absence of three-wire input signal

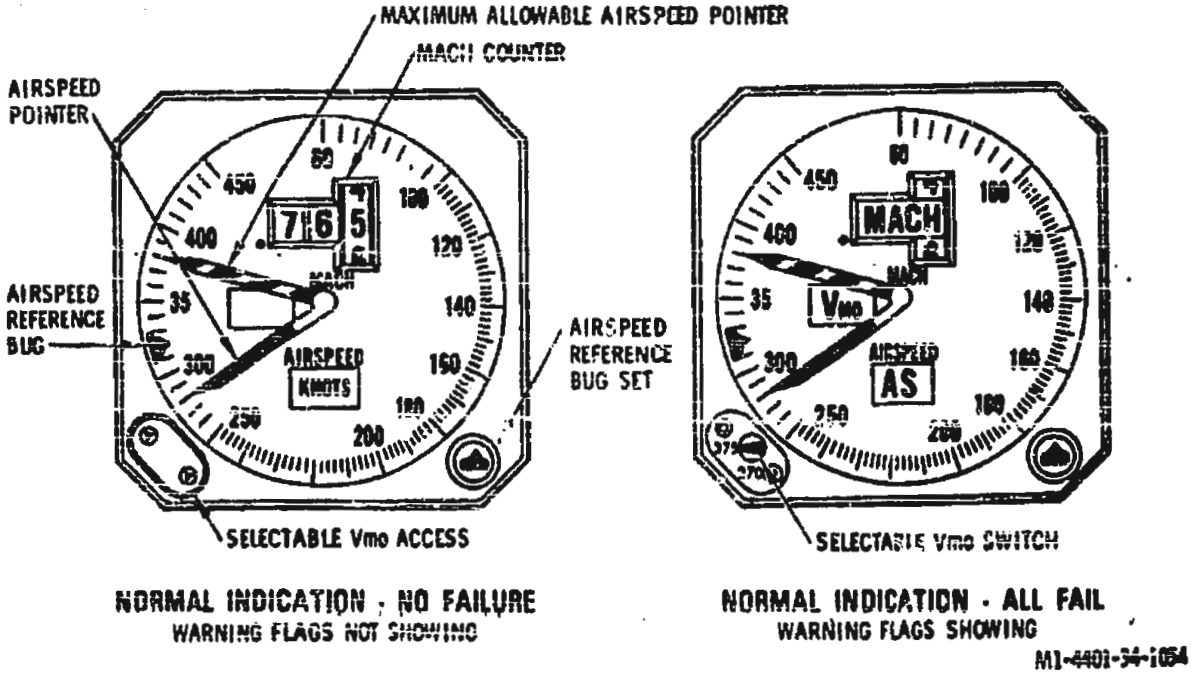
Persistent excessive servo null

Open circuit in the transolver windings

Absence of externally supplied 28V dc data valid signal

B. Operation

The indicators receive computed airspeed, coarse altitude (used to compute maximum allowable airspeed), and Mach number data from the ADC as three-wire transolver signals. Separate dc servo loops drive each of the three displays. These servo loops differ only in gear ratios required for various scale factors and in characterization methods required to provide nonlinear airspeed dial scale factor for computed and maximum allowable airspeeds. Each servo loop drives a bootstrap transolver. The computed airspeed transolver provides a comparison output to the central instrument warning system (Ref. 34-16-00). An overspeed warning is provided by comparison of computed airspeed with maximum allowable airspeed; a switching device closes an external circuit in the event of an overspeed condition. This overspeed warning signal is provided to the aural warning system (clacker) (Ref. 31-22-00). A ram air turbine (RAT) lockout circuit is provided to prevent RAT extension



Airspeed/Mach Indicator
Figure 6

below 100-knots (Ref. 29-21-00). This is one link in the RAT lockout chain.

8. Vertical Speed Indicator

A. Description

The indicators (Ref. Fig. 7) are solid-state, dc-servoed instruments which display vertical speed information from the ADC. They are mounted, one each, on Captains and First Officers instrument panels, zones 211 and 212, they receive data from ADC No. 1 and 2, respectively. Bootstrap repeaters provide an output from each instrument to the other so they can be operated individually from their respective ADC, or together from either computer.

A functionally separate failure monitor circuit controls the red warning flag which drops into view when any of the following conditions (failures) is detected:

Absence of primary power

Internal power supply failure

Persistent excessive servo null

Vertical speed signal out of operational limits

Absence of vertical speed 26V ac reference input signal

Absence of externally supplied 28V dc data valid signal

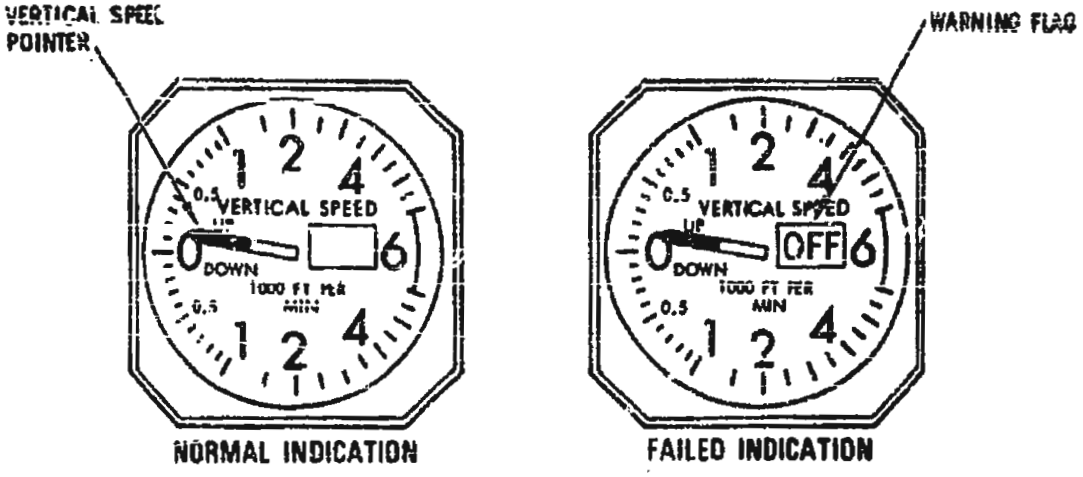
The bootstrapped vertical speed information is also supplied to the central instrument warning system (Ref. 34-16-00). Integral lighting is provided (Ref. 33-11-00).

B. Operation

Vertical speed information is supplied by the ADC as an ac phase-reversing voltage. It is demodulated and drives a dc servo repositioning a potentiometer to null the input signal, this moves the pointer to the corresponding vertical speed. An isolation amplifier output ahead of the demodulator provides the bootstrap vertical speed output. The internal failure monitor controls the fail warning flag and provides a data valid output signal.

9. Total Air Temperature Sensor

A. Description and Operation



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R Vertical Speed Indicator
R Figure 7

EFFECTIVITY: ALL

0018

The total air temperature sensor (probe) provides temperature measurement of the ram air outside the aircraft for the air data computer system(Ref. Fig. 8). There are two sensor probes installed at the bottom forward section of the aircraft fuselage, zone 112. Each probe is contained in a housing. A single electrical connector provides system interface.

The total air temperature probe is provided with an electric heater mounted integrally within the probe housing. The heater (Ref. 30-31-00) is a temperature-compensating-type heater which reduces the heat generated when the housing temperature rises. The heater operating voltage is 115V ac, 400-Hz.

Two temperature sensing elements are located in the total air temperature probe strut. Each sensing element consists of platinum wire with 500-ohms resistance at 0-degrees C. The sensing elements are insulated and hermetically sealed in two concentric tubes.

10. True Airspeed (TAS) Indicator

A. Description and Operation

The TAS indicator (Ref. Fig. 9) provides a digital display of true airspeed data as received from ADC NO. 2. The TAS indicator is housed in a cylindrical envelope containing TAS counter and failure warning assembly. The indicator is mounted on the First Officers instrument panel, zone 212. A single electrical connector provides system interface.

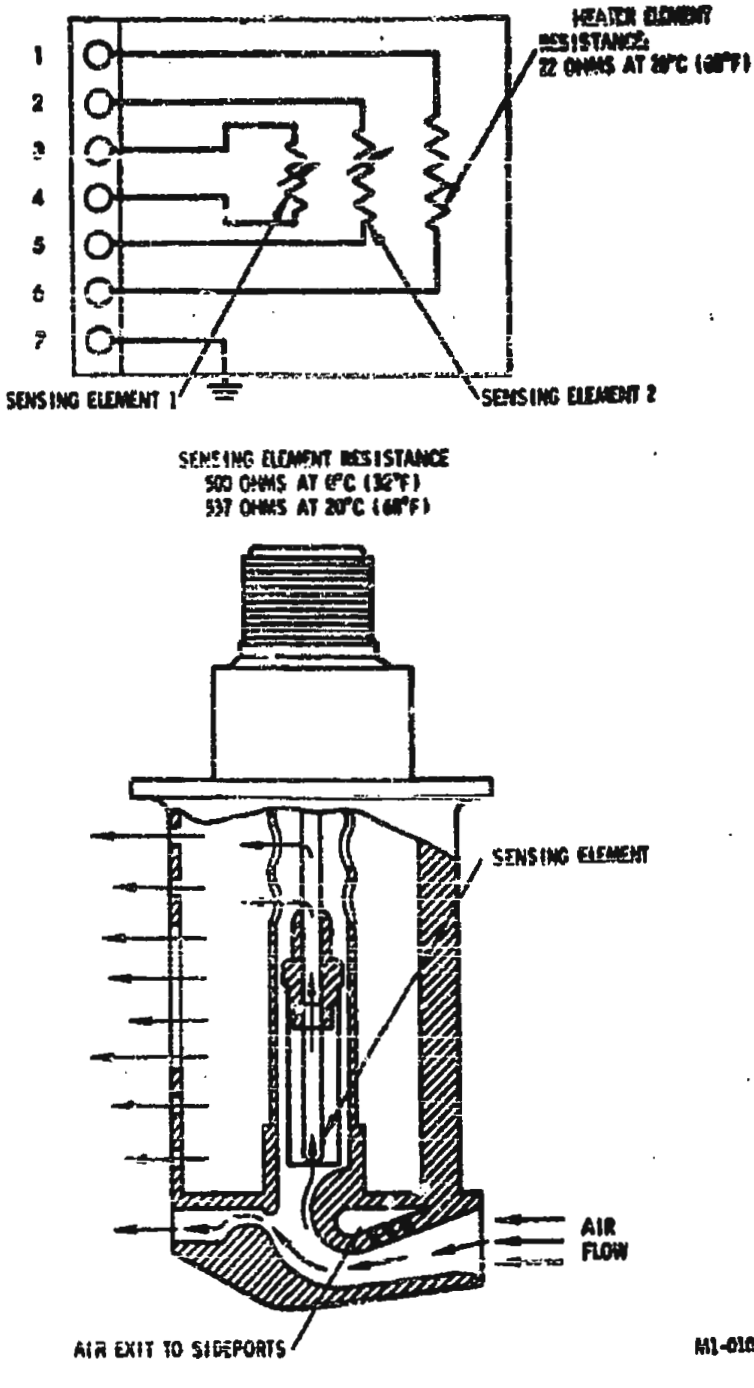
The indicator primary power is 115V ac, 400-Hz. The instrument lighting power is 5V ac, 400-Hz. The true airspeed display is a servo-driven, three-drum counter which displays airspeed in knots. The servo is driven by a dc torque motor using potentiometer feedback. The indicator displays three digits over a range of 100 to 599-knots. Integral lighting is provided (Ref. 33-11-00).

Failure warning consists of the failure flag controlled by the failure monitor. The flag is held out of view by an energized solenoid. The flag-holding voltage is inhibited, causing the flag to appear, if any of the following conditions occur:

Absence of primary power

Internal power supply failure

Persistent excessive servo null



Total Air Temperature Sensor
Figure 8

True airspeed signal out of operational limits

Absence of external validity signal

11. Digital Air Data Computer Testing

A. Description

Figure 10, Sheet 1 describes DADC LAMP TEST, SELF TEST, and SLEW TEST.

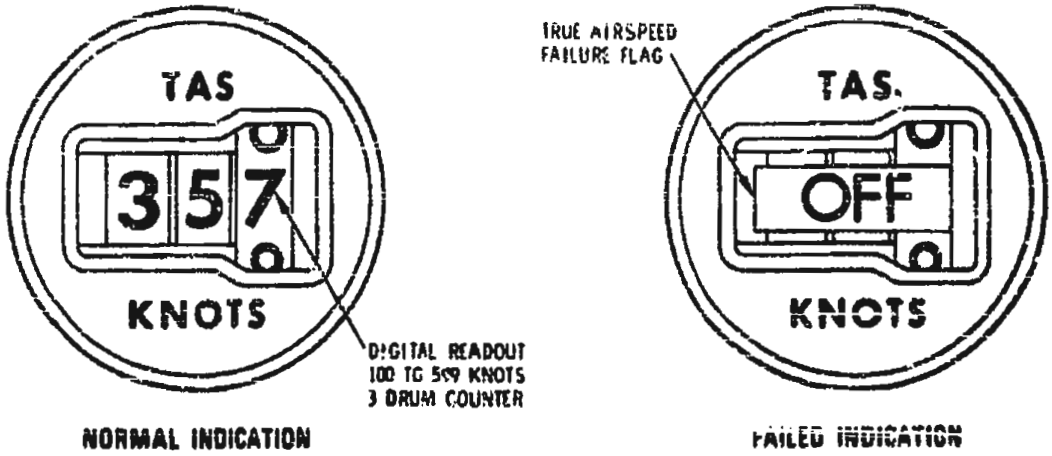
DADC Testing cannot be performed if computed airspeed is greater than 100-knots.

Test switch must be held for at least one second, but not more than 10-seconds, if DADC SELF TEST is to be performed.

Instrument fail flags will appear during DADC SELF TEST. They must disappear at completion of SELF TEST.

SELF TEST must be completed before SLEW TEST can be performed.

If SLEW TEST is not initiated within 15-seconds of SELF TEST completion, the DADC will revert to normal operation.



True Airspeed Indicator
Figure 9

SLEW TEST can be held any time during test.

The DADC will return to normal operation at completion of SLEW TEST, or after SLEW TEST has been held.

B. Operation

NOTE: Prior to DADC testing, set Baro Altitude Indicator to 29.92 (1013mb).

STEP A. LAMPS TEST

(1) Push and hold test switch for at least one second, but no more than 10-seconds, FAULT lamp must come on while test switch is pressed (LAMP TEST).

NOTE: If test button is held for less than one second or more than 10-seconds, program will revert to normal operation.

STEP B. DADC SELF TEST

(1) When test switch is released:

(a) FAULT lamp must go OUT.

(b) TEST IN PROGRESS lamp must come ON steady, indicating Test in Progress.

(c) All air data instrument fail flags must appear.

(2) Approximately 10-seconds after test switch is released.

(a) TEST IN PROGRESS lamp must flash, FAULT light must be OUT.

(b) Air data instrument flags must disappear.

(c) TEST IN PROGRESS light must flash for approximately 15/seconds indicating SELF TEST complete, and then go OUT. While TEST IN PROGRESS lamp is flashing, the air data instruments must indicate test parameters.

STEP C. SLEW TEST

(1) When TEST IN PROGRESS lamp is flashing, press test switch again for at least one second and release.

(2) TEST IN PROGRESS light must come on steady.

(3) Observe that air data instruments are slewing and no flags are in view.

(4) Figure 10 (Sheet 2) identifies DADC SELF and SLEW test outputs to flight instruments.

(a) SELF TEST outputs are those shown at ZERO time and 4.5-minutes.

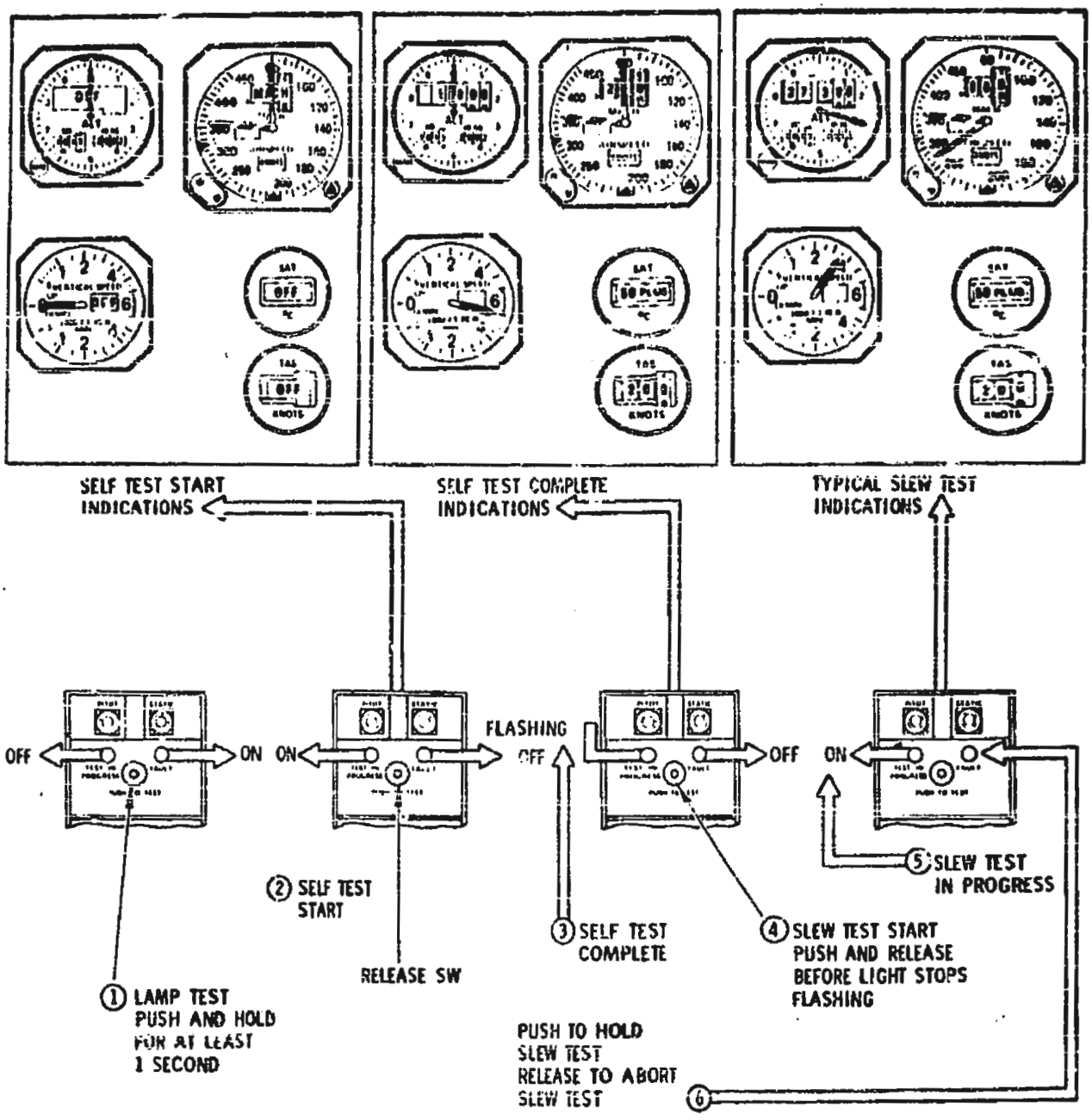
(b) Between time 0.5 and 1.0-minutes, VSI, ALTITUDE and VMO outputs are stable at 0-FT/MIN, 9,600-FT and 372-KNOTS respectively.

(c) Whe IAS rises above VMO at approximately 1.5 and 3.0-minutes, an aircraft overspeed aural warning will be heard for approximately 7-seconds.

(d) All outputs remain stable between time 2.0 and 2.5-minutes.

(e) Stable altitude outputs at 9,600-FT and 27,300-FT enable transponder altitude reporting checks to be made.

(5) Press TEST switch during SLEW TEST will hold all outputs at levels existing when switch was pressed. Upon release, DADC outputs will revert rapidly to normal operation.



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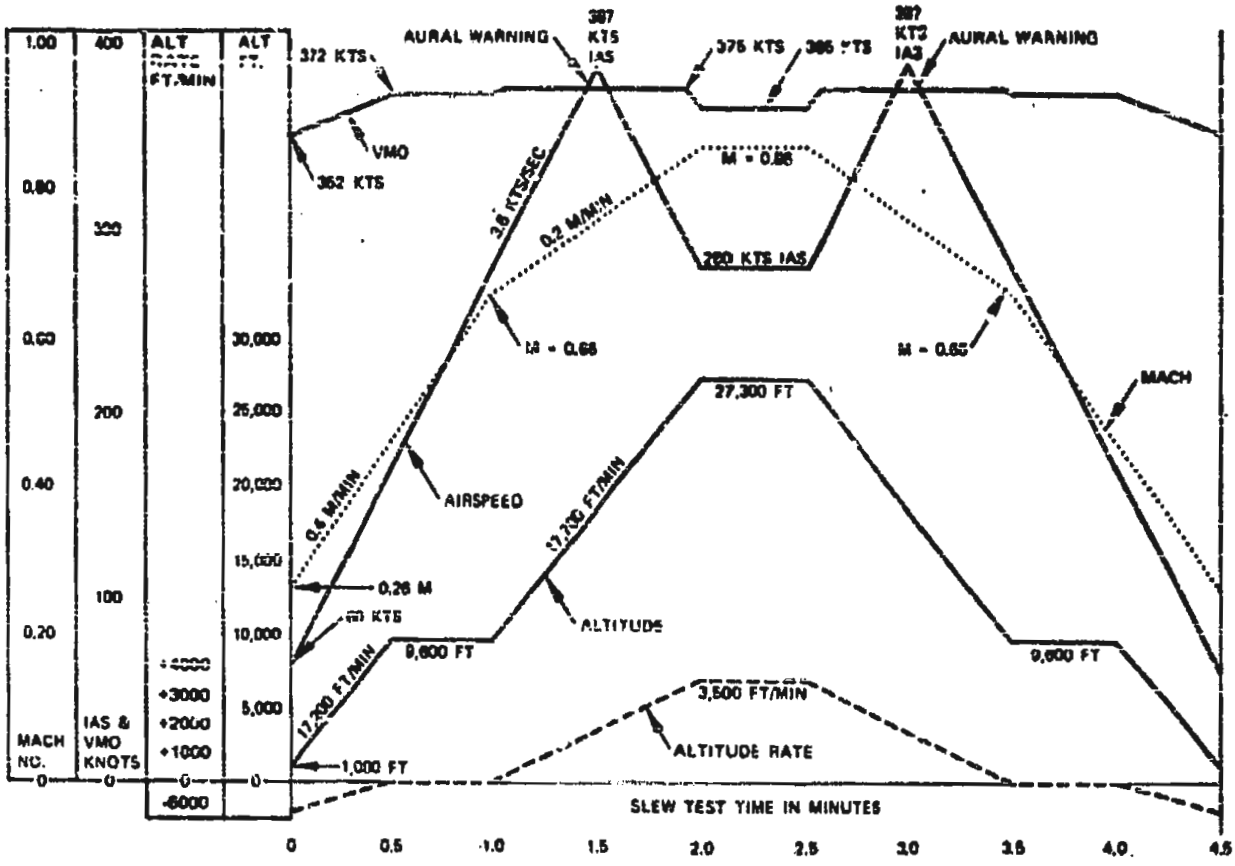
DADC Testing
Figure 10 (Sheet 1)



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DADC Testing
Figure 10 (Sheet 2)

AIR DATA COMPUTER - FAULT ISOLATION

R 1. General

R NOTE: This fault isolation procedure covers analog and digital
R installations. As analog and digital ADCs are
R interchangeable, except on Dash 500 aircraft, there is
R the possibility of a mixed configuration. This does not
R affect wiring or outputs in any way, the only difference
R is in the AC input connections to the ADCs.

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code, the code number can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for a more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Equipment and Materials

C Pitot/Static field tester, Type MB-1; or Pitot/Static tester,
C Burton 2024B, or equivalent (2 required).

C NOTE: Refer to Chapter 34 of Illustrated Tool and Equipment
C Manual for description and operation.

3. Supplemental Fault Isolation Data

C The data provided in Table 101 is to be used as a guide when fault isolating altitude indicators. On ground, all altitude indicators must indicate field elevation +60, -40-feet when barometric scale setting knob has been adjusted for ambient atmospheric pressure corrected to sea level (QNH or tower setting).

Altimeter Tolerances
Table 101

	ALTITUDE	ERROR BETWEEN SERVOED ALTIMETERS	ERROR BETWEEN SERVOED AND PNEUMATIC ALTIMETER
C	0-8,000-ft	40-ft	70-ft
C C	8,000-15,000-ft	60-ft	110-ft
C C	15,000-20,000-ft	80-ft	180-ft
C C	20,000-25,000-ft	100-ft	210-ft
C C	25,000-30,000-ft	120-ft	240-ft
C C	30,000-35,000-ft	140-ft	280-ft
C	35,000-40,000-ft	160-ft	280-ft

SAT/TAS Chart
Table 102

PROBE TEMP °C	M - .407		M - .791		M - .900 (SELF TEST)	
	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS
-5	-14	256	-35	476	-42	533
-4	-13	256	-34	477	-41	534
-3	-12	257	-33	478	-41	535
-2	-11	257	-32	478	-40	536
-1	-10	257	-31	479	-39	537

SAT/TAS Chart (Cont)
Table 102

PROBE TEMP °C	M - .407		M - .791		M - .900 (SELF TEST)	
	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS
0	-9	258	-30	480	-38	538
1	-8	258	-29	481	-37	539
2	-7	259	-29	482	-36	540
3	-6	259	-28	483	-35	541
4	-5	260	-27	484	-35	542
5	-4	260	-26	485	-34	543
6	-3	261	-25	486	-33	544
7	-2	261	-24	486	-32	545
8	-1	262	-23	487	-31	546
9	0	262	-22	488	-30	547
10	1	263	-21	489	-29	548
11	2	263	-21	490	-29	549
12	3	263	-20	491	-28	549
13	4	264	-19	492	-27	550
14	5	264	-18	492	-26	551
15	6	265	-17	493	-25	552
16	7	265	-16	494	-24	553
17	8	266	-15	495	-23	554
18	9	266	-14	496	-23	555
19	10	267	-13	497	-22	556
20	11	267	-13	498	-21	557
21	12	268	-12	498	-20	558
22	13	268	-11	499	-19	559
23	14	268	-10	500	-18	560
24	14	269	-9	501	-17	561
25	15	269	-8	502	-16	562
26	16	270	-7	503	-16	563
27	17	270	-6	503	-15	564
28	18	271	-5	504	-14	565
29	19	271	-5	505	-13	566
30	20	272	-4	506	-12	567
31	21	272	-3	507	-11	567
32	22	273	-2	508	-10	568
33	23	273	-1	508	-10	569
34	24	273	0	509	-9	570

SAT/TAS Chart (Cont)
Table 102

PROBE TEMP °C	M - .407		M - .791		M - .900 (SELF TEST)	
	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS
35	25	274	1	510	-8	571
36	26	274	2	511	-7	572
37	27	275	3	512	-6	573
38	28	275	3	513	-5	574
39	29	276	4	513	-4	575
40	30	276	5	514	-4	576
41	31	277	6	515	-3	577
42	32	277	7	516	-2	578
43	33	277	8	517	-1	579
44	34	278	9	518	0	579
45	35	278	10	518	1	580
46	36	279	11	519	2	581
47	37	279	11	520	2	582
48	38	280	12	521	3	583
49	39	280	13	522	4	584

TOLERANCES: SAT ±5°C; TAS ±10 KNOTS

4. Fault Isolation Identification

Table 103 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide component locations for Air Data Computer System and associated components.

R Fault Isolation Diagrams and Schematics List
R Table 103

FIGURE NUMBER	TITLE
101	Component Location Index
102	Component Locator Diagram
103	ALTM Problems
104	AS/M Problems

R R Fault Isolation Diagrams and Schematics List (Cont)
Table 103

	FIGURE NUMBER	TITLE
	105	VSI Problems
	106	SELF-TEST (BITE) Problems
	107	SAT/TAS Problems
R	SCHEM 1	ADC System Schematic
R	SCHEM 2	Air Data Computer No. 1 Interface Schematic
R	SCHEM 3	Air Data Computer No. 2 Interface Schematic
R R	SCHEM 4	Altitude Indicator and Altitude Select Panel Interface Schematic
R	SCHEM 5	Airspeed Indicator Interface Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
INDICATOR – AIRSPEED/MACH	2	FLT STA, CAPT AND F/O INSTR PNL	34-14-04
INDICATOR – BARO ALTITUDE	2	FLT STA, CAPT AND F/O INSTR PNL	34-14-03
INDICATOR – TRUE AIRSPEED	1	FLT STA, F/O INSTR PNL	34-14-08
INDICATOR – VERTICAL SPEED	2	FLT STA, CAPT AND F/O INSTR PNL	34-14-05
RELAY – ALT PWR TRANSFER (K9)	1	FESC, ABOVE FWD RACK/112AB	20-24-03
SENSOR – TOTAL AIR TEMP	2	FUSELAGE, NOSE AREA	34-14-06

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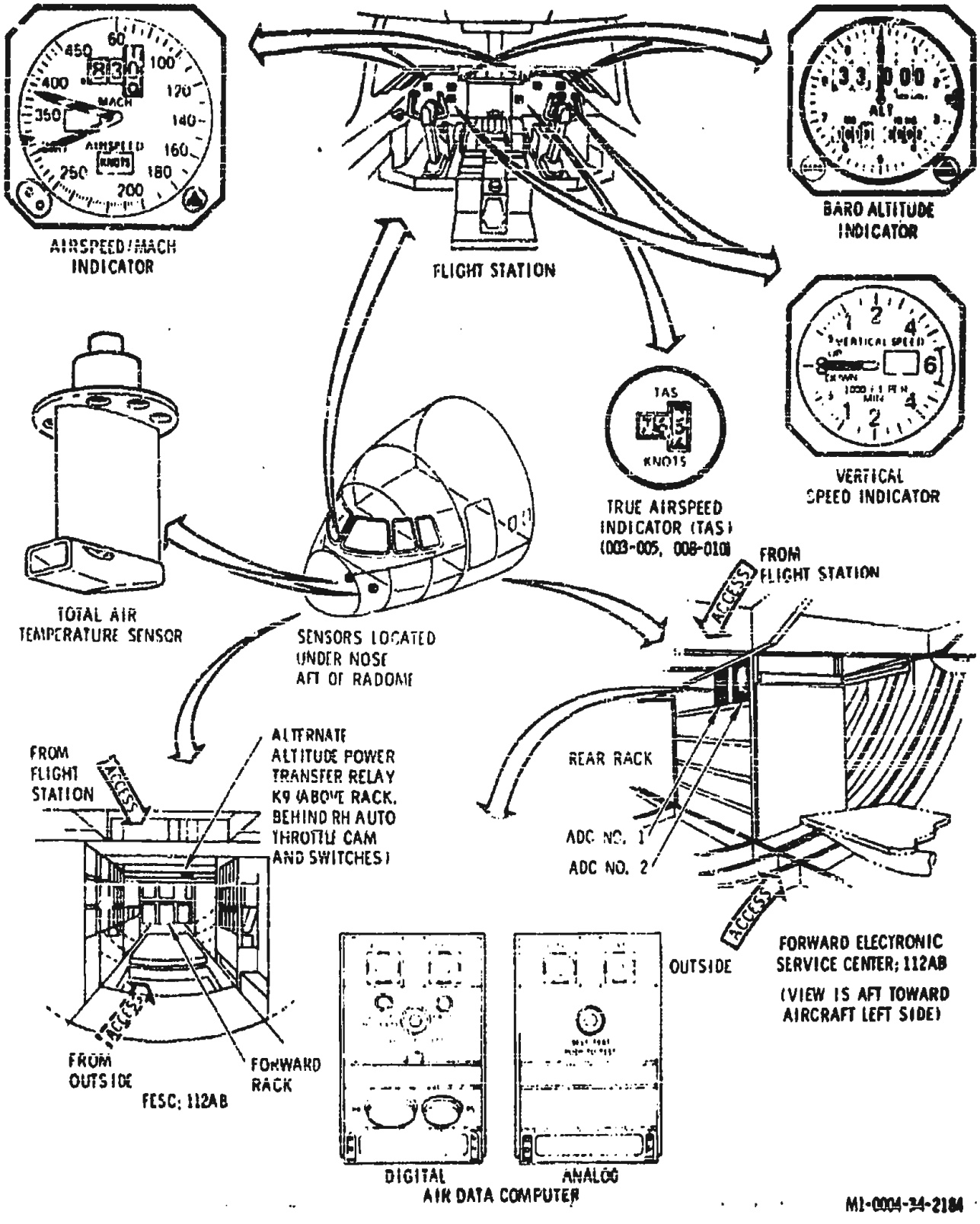
R
R Component Location Index
Figure 101

R EFFECTIVITY: ALL
R
001B



R Component Locator Diagram
R Figure 102

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S: 1F4, 1F22, 168, 1627, 2A21
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED AND SERVOED ALTIMETERS SET TO LOCAL BAROMETRIC PRESSURE
ADC SYSTEM 1 SHOWN; ADC SYSTEM 2 SHOWN IN PARENTHESIS

ALTM PROBLEMS

1 IS THE STANDBY ALTIMETER INOPERATIVE, OR DOES IT STICK? — YES → 11 REPLACE STANDBY ALTIMETER (MM34-13-04).

NO

2 IS STANDBY ALTIMETER BARO SET INOPERATIVE? — YES → 11

NO

3 DOES STANDBY ALTIMETER EXCEED DISAGREEMENT LIMITS FROM PRIMARY ALTIMETER? /1\ — YES → 11

NO

4 DO SERVOED ALTIMETERS EXCEED DISAGREEMENT LIMITS? FLAGS OR ALTITUDE ANNUNCIATION ON INSTR COMPARATOR MAY BE IN VIEW. — YES → 7 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DO CAPT (F/O) SERVOED ALTIMETER STILL EXCEED DISAGREEMENT LIMITS? REFER TO TABLE 102 FOR DISAGREEMENT LIMITS.

7 — NO → 12 REPLACE ADC NO. 1 (2) (MM34-14-01).

7 — YES → 13 REPLACE CAPT (F/O) SERVOED ALTIMETER (MM34-14-03).

NO

5 IS CAPT (F/O) SERVOED ALTIMETER POINTER AND/OR COUNTER INOPERATIVE, OR DO THEY STICK? — YES → 8 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. IS PROBLEM CURED?

8 — NO → 13

8 — YES → 14 REPLACE ADC NO. 1 (2) (MM34-14-01).

NO

6 IS CAPT (F/O) SERVOED ALTIMETER BARO SET ADJUST INOPERATIVE? — YES → 9 ON CAPT (F/O) ALTN SET BARO ADJUST TO 29.92 (1013 MB) AND RECORD ALTITUDE. SET BARO TO 29.38 (995 MB). VERIFY ALTITUDE IS 475 TO 525 FT LOWER THAN RECORDED ALTITUDE. SET BARO TO 30.46 (1031 MB). IS ALTITUDE 475 TO 525 FT ABOVE RECORDED ALTITUDE?

9 — NO → 15 REPLACE CAPT (F/O) SERVOED ALTIMETER (MM34-14-03).

TO SHEET 2

9 — YES → 10 OPERATION NORMAL.

NOTE
/1\ SEE TABLE 102

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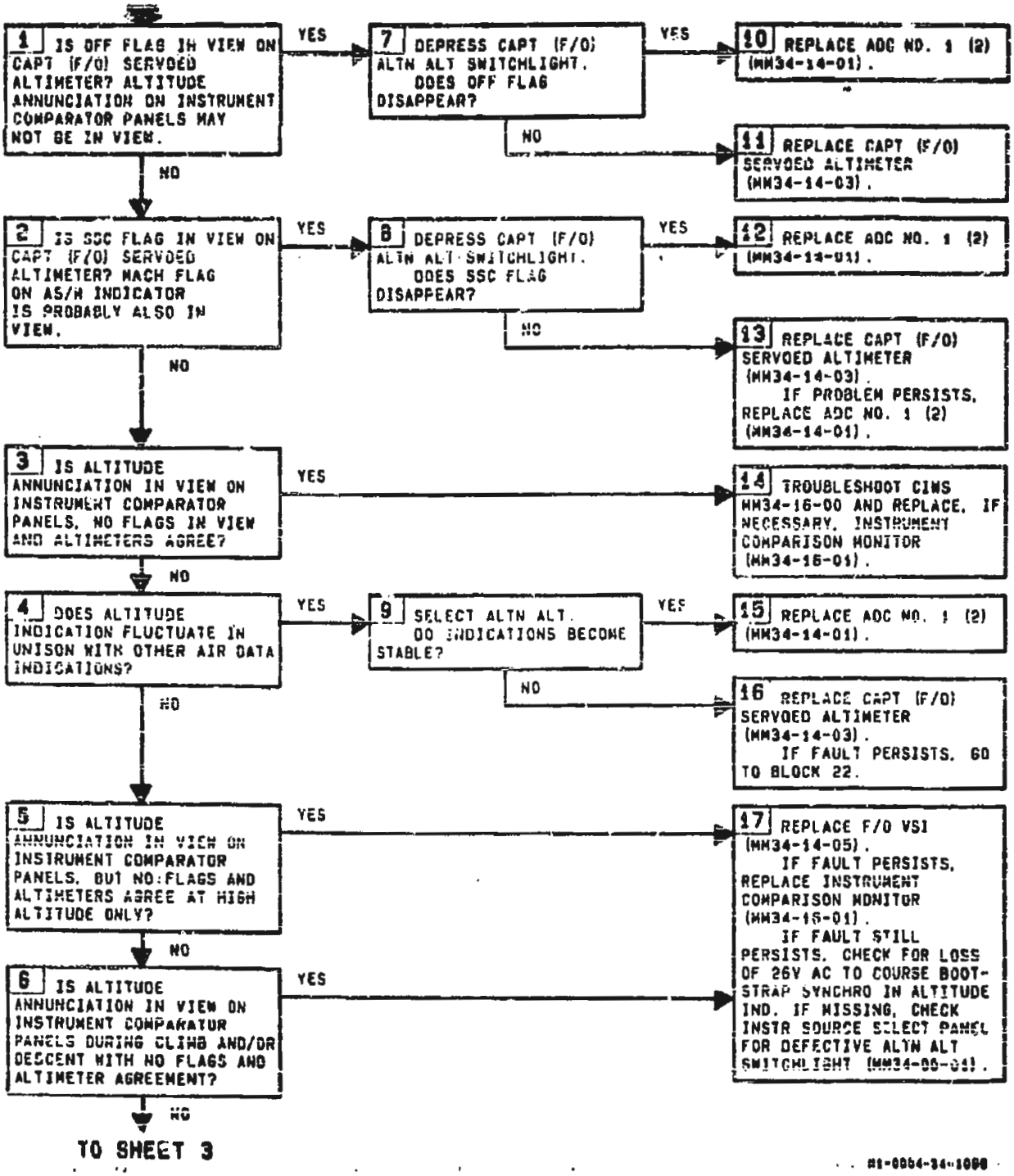
ALTM Problems
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

PREREQUISITES
SEE SHEET 1

FROM SHEET 1


1 IS OFF FLAG IN VIEW ON CAPT (F/O) SERVOED ALTIMETER? ALTITUDE ANNUNCIATION ON INSTRUMENT COMPARATOR PANELS MAY NOT BE IN VIEW.
YES
7 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DOES OFF FLAG DISAPPEAR?
YES
10 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
11 REPLACE CAPT (F/O) SERVOED ALTIMETER (MM34-14-03).
NO
2 IS SSC FLAG IN VIEW ON CAPT (F/O) SERVOED ALTIMETER? MACH FLAG ON AS/M INDICATOR IS PROBABLY ALSO IN VIEW.
YES
8 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DOES SSC FLAG DISAPPEAR?
YES
12 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
13 REPLACE CAPT (F/O) SERVOED ALTIMETER (MM34-14-03). IF PROBLEM PERSISTS, REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
3 IS ALTITUDE ANNUNCIATION IN VIEW ON INSTRUMENT COMPARATOR PANELS, NO FLAGS IN VIEW AND ALTIMETERS AGREE?
YES
14 TROUBLESHOOT CIMS MM34-16-00 AND REPLACE, IF NECESSARY, INSTRUMENT COMPARISON MONITOR (MM34-16-01).
NO
4 DOES ALTITUDE INDICATION FLUCTUATE IN UNISON WITH OTHER AIR DATA INDICATIONS?
YES
9 SELECT ALTN ALT. DO INDICATIONS BECOME STABLE?
YES
15 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
16 REPLACE CAPT (F/O) SERVOED ALTIMETER (MM34-14-03). IF FAULT PERSISTS, GO TO BLOCK 22.
NO
5 IS ALTITUDE ANNUNCIATION IN VIEW ON INSTRUMENT COMPARATOR PANELS, BUT NO FLAGS AND ALTIMETERS AGREE AT HIGH ALTITUDE ONLY?
YES
17 REPLACE F/O VSI (MM34-14-05). IF FAULT PERSISTS, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01). IF FAULT STILL PERSISTS, CHECK FOR LOSS OF 26V AC TO COURSE BOOTSTRAP SYNCHRO IN ALTITUDE IND. IF MISSING, CHECK INSTR SOURCE SELECT PANEL FOR DEFECTIVE ALTN ALT SWITCHLIGHT (MM34-00-01).
NO
6 IS ALTITUDE ANNUNCIATION IN VIEW ON INSTRUMENT COMPARATOR PANELS DURING CLIMB AND/OR DESCENT WITH NO FLAGS AND ALTIMETER AGREEMENT?
YES
NO
TO SHEET 3

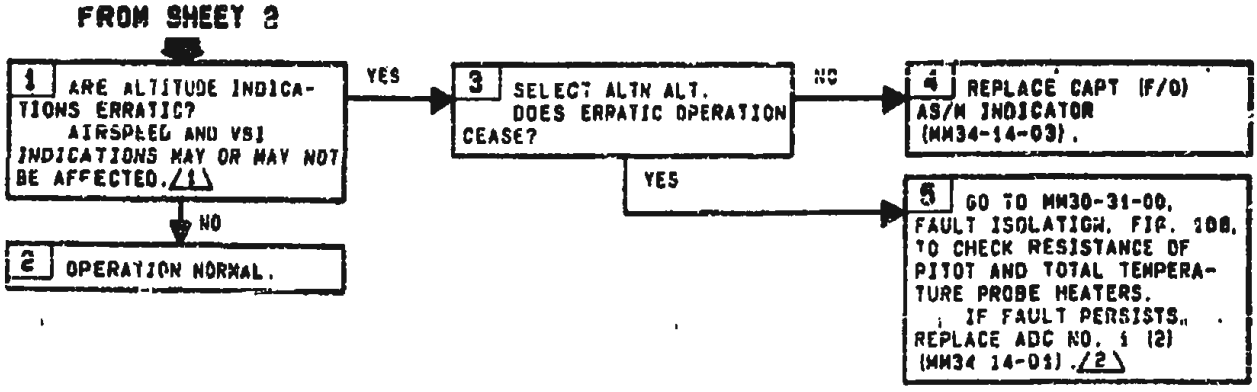
R
R

ALTM Problems
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

001B

PREREQUISITES
SEE SHEET 1

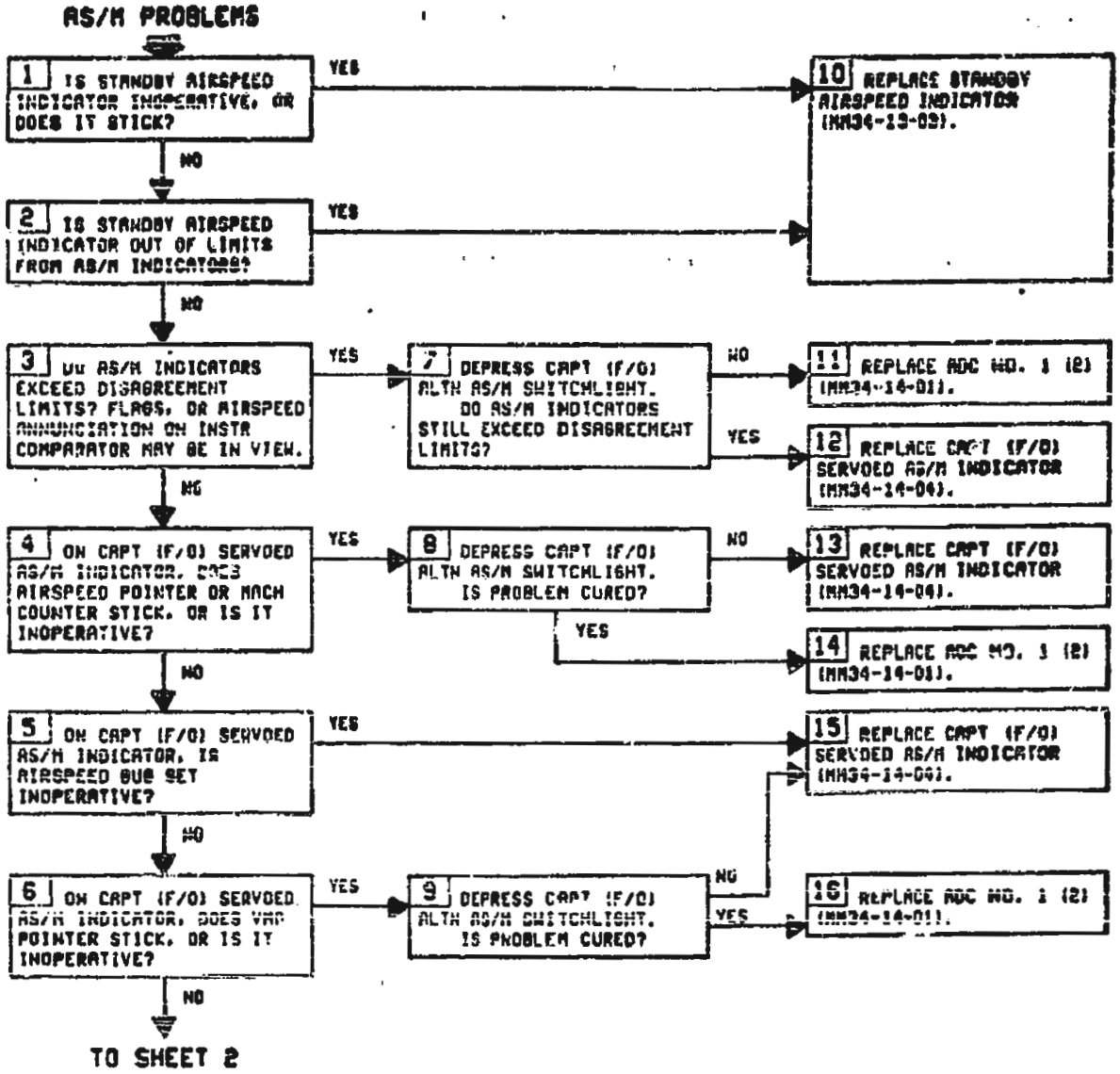

FROM SHEET 2
1 ARE ALTITUDE INDICATIONS ERRATIC?
AIRSPEED AND VSI INDICATIONS MAY OR MAY NOT BE AFFECTED. /1\
YES
NO
2 OPERATION NORMAL.
3 SELECT ALTN ALT. DOES ERRATIC OPERATION CEASE?
NO
YES
4 REPLACE CAPT (F/O) AS/M INDICATOR (MM34-14-03).
5 GO TO MM30-31-00, FAULT ISOLATION, FIG. 108, TO CHECK RESISTANCE OF PITOT AND TOTAL TEMPERATURE PROBE HEATERS.
IF FAULT PERSISTS, REPLACE ADC NO. 1 (2) (MM34-14-01). /2\

NOTE

/1\ IF THIS PROBLEM OCCURRED IN FLIGHT AND DOES NOT SHOW UP ON GROUND, PROCEED THRU BLOCK 5 IN ALL CASES WITH STRICT ADHERENCE TO PROBE HEATER RESISTANCE CHECKS.

/2\ ALWAYS CHECK HEATER RESISTANCE BEFORE ATTEMPTING TO CHANGE ADC.

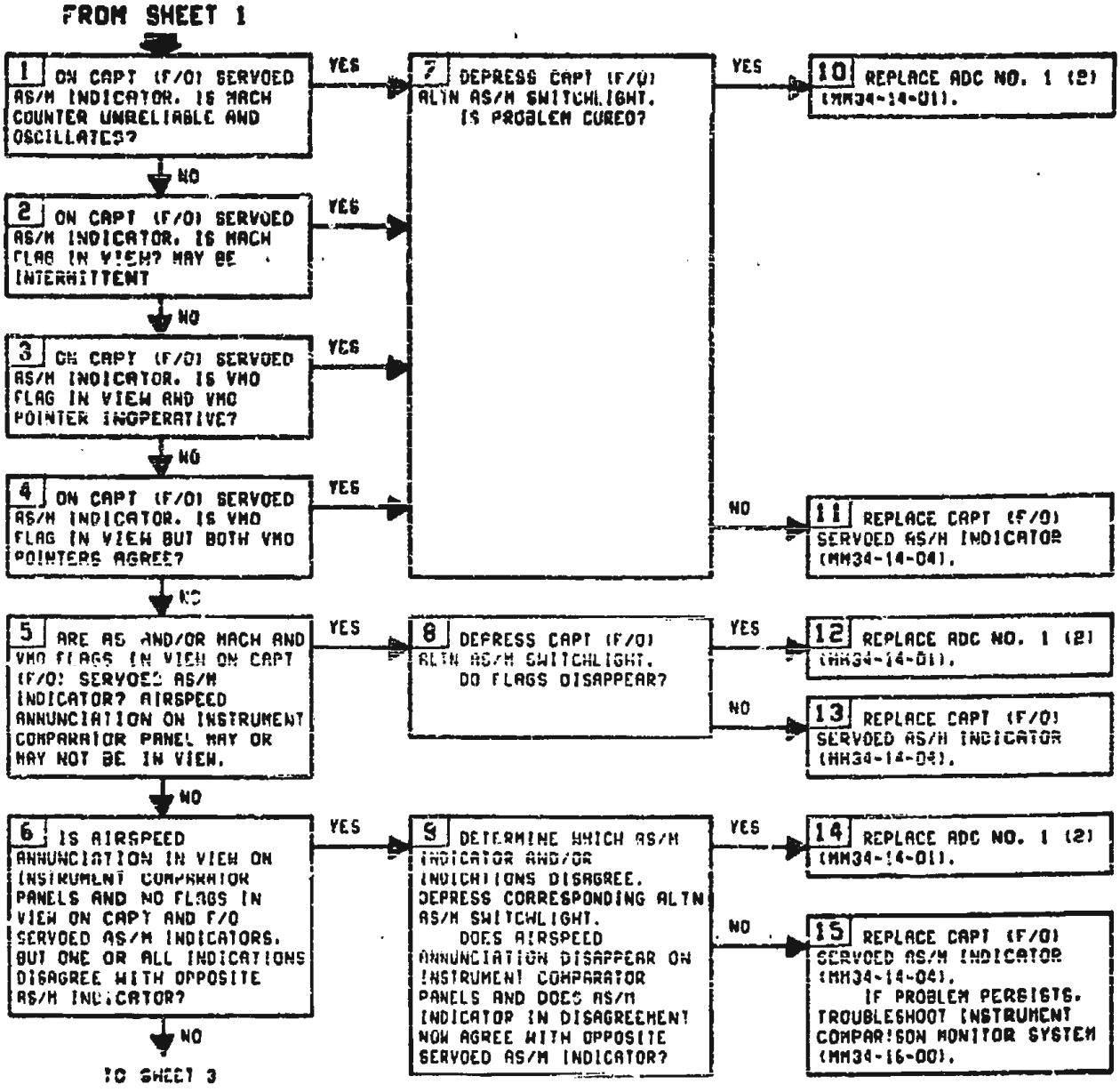
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-29-00)
CB'S: 1F1, 1F18, 188, 1927, 2A21
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
ADC SYSTEM 1 SHOWN; ADC SYSTEM 2 SHOWN IN PARENTHESIS


AS/M PROBLEMS
1 IS STANDBY AIRSPEED INDICATOR INOPERATIVE, OR DOES IT STICK?
YES
10 REPLACE STANDBY AIRSPEED INDICATOR (MM34-13-03).
NO
2 IS STANDBY AIRSPEED INDICATOR OUT OF LIMITS FROM AS/M INDICATORS?
YES
NO
3 DO AS/M INDICATORS EXCEED DISAGREEMENT LIMITS? FLAGS, OR AIRSPEED ANNUNCIATION ON INSTR COMPARATOR MAY BE IN VIEW.
YES
7 DEPRESS CAPT (F/O) ALTN AS/M SWITCHLIGHT. DO AS/M INDICATORS STILL EXCEED DISAGREEMENT LIMITS?
NO
11 REPLACE ADC NO. 1 (2) (MM34-14-01).
YES
12 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04).
NO
4 ON CAPT (F/O) SERVOED AS/M INDICATOR, DOES AIRSPEED POINTER OR MACH COUNTER STICK, OR IS IT INOPERATIVE?
YES
8 DEPRESS CAPT (F/O) ALTN AS/M SWITCHLIGHT. IS PROBLEM CURED?
NO
13 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04).
YES
14 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
5 ON CAPT (F/O) SERVOED AS/M INDICATOR, IS AIRSPEED BUG SET INOPERATIVE?
YES
15 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04).
NO
6 ON CAPT (F/O) SERVOED AS/M INDICATOR, DOES VMO POINTER STICK, OR IS IT INOPERATIVE?
YES
9 DEPRESS CAPT (F/O) ALTN AS/M SWITCHLIGHT. IS PROBLEM CURED?
NO
YES
16 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
TO SHEET 2

AS-0005-34-1311

AS/M Problems
Figure 104 (Sheet 1)

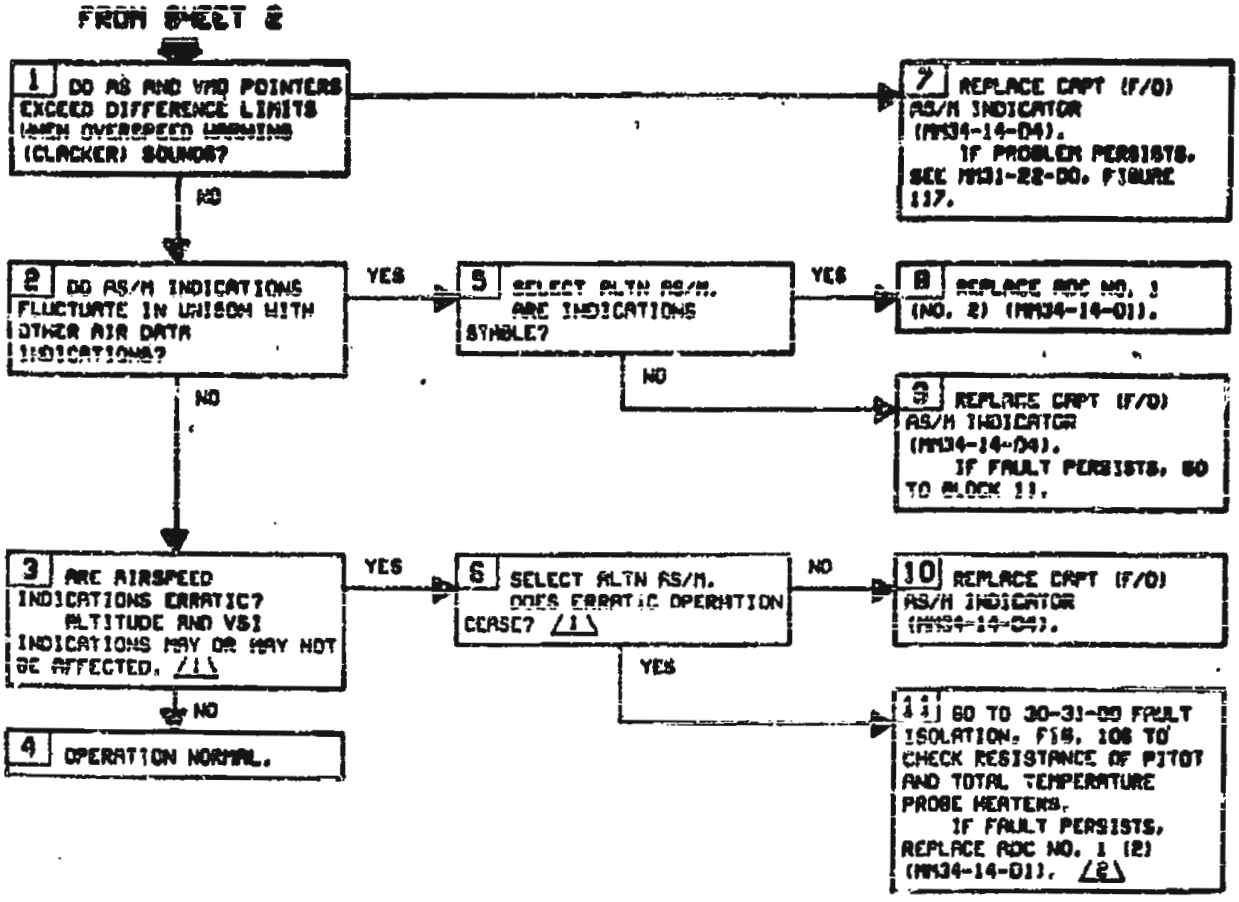
PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 ON CAPT (F/O) SERVOED AS/M INDICATOR, IS MACH COUNTER UNRELIABLE AND OSCILLATES?
YES
NO
2 ON CAPT (F/O) SERVOED AS/M INDICATOR, IS MACH FLAG IN VIEW? MAY BE INTERMITTENT
YES
NO
3 ON CAPT (F/O) SERVOED AS/M INDICATOR, IS VMO FLAG IN VIEW AND VMO POINTER INOPERATIVE?
YES
NO
4 ON CAPT (F/O) SERVOED AS/M INDICATOR, IS VMO FLAG IN VIEW BUT BOTH VMO POINTERS AGREE?
YES
NO
5 ARE AS AND/OR MACH AND VMO FLAGS IN VIEW ON CAPT (F/O) SERVOED AS/M INDICATOR? AIRSPEED ANNUNCIATION ON INSTRUMENT COMPARATOR PANEL MAY OR MAY NOT BE IN VIEW.
YES
NO
6 IS AIRSPEED ANNUNCIATION IN VIEW ON INSTRUMENT COMPARATOR PANELS AND NO FLAGS IN VIEW ON CAPT AND F/O SERVOED AS/M INDICATORS, BUT ONE OR ALL INDICATIONS DISAGREE WITH OPPOSITE AS/M INDICATOR?
YES
NO
TO SHEET 3
7 DEPRESS CAPT (F/O) ALTN AS/M SWITCHLIGHT. IS PROBLEM CURED?
YES
NO
8 DEPRESS CAPT (F/O) ALTN AS/M SWITCHLIGHT. DO FLAGS DISAPPEAR?
YES
NO
9 DETERMINE WHICH AS/M INDICATOR AND/OR INDICATIONS DISAGREE. DEPRESS CORRESPONDING ALTN AS/M SWITCHLIGHT. DOES AIRSPEED ANNUNCIATION DISAPPEAR ON INSTRUMENT COMPARATOR PANELS AND DOES AS/M INDICATOR IN DISAGREEMENT NOW AGREE WITH OPPOSITE SERVOED AS/M INDICATOR?
YES
NO
10 REPLACE ADC NO. 1 (2) (MM34-14-01).
11 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04).
12 REPLACE ADC NO. 1 (2) (MM34-14-01).
13 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04).
14 REPLACE ADC NO. 1 (2) (MM34-14-01).
15 REPLACE CAPT (F/O) SERVOED AS/M INDICATOR (MM34-14-04). IF PROBLEM PERSISTS, TROUBLESHOOT INSTRUMENT COMPARISON MONITOR SYSTEM (MM34-16-00).

R1-0007-34-1210

AS/M Problems
Figure 104 (Sheet 2)

PREREQUISITES
SEE SHEET 1


FROM SHEET 2
1 DO AS AND VMO POINTERS EXCEED DIFFERENCE LIMITS WHEN OVERSPEED WARNING (CLACKER) SOUNDS?
7 REPLACE CAPT (F/O) AS/M INDICATOR (MM34-14-04). IF PROBLEM PERSISTS, SEE MM31-22-00, FIGURE 117.
NO
2 DO AS/M INDICATIONS FLUCTUATE IN UNISON WITH OTHER AIR DATA INDICATIONS?
YES
5 SELECT ALTN AS/M. ARE INDICATIONS STABLE?
YES
8 REPLACE ADC NO. 1 (NO. 2) (MM34-14-01).
NO
9 REPLACE CAPT (F/O) AS/M INDICATOR (MM34-14-04). IF FAULT PERSISTS, GO TO BLOCK 11.
NO
3 ARE AIRSPEED INDICATIONS ERRATIC? ALTITUDE AND VSI INDICATIONS MAY OR MAY NOT BE AFFECTED. /1\
YES
6 SELECT ALTN AS/M. DOES ERRATIC OPERATION CEASE? /1\
NO
10 REPLACE CAPT (F/O) AS/M INDICATOR (MM34-14-04).
NO
4 OPERATION NORMAL.
YES
11 GO TO 30-31-00 FAULT ISOLATION, FIG. 108 TO CHECK RESISTANCE OF PITOT AND TOTAL TEMPERATURE PROBE HEATERS. IF FAULT PERSISTS, REPLACE ADC NO. 1 (2) (MM34-14-01). /2\

NOTE

/1\ IF THIS PROBLEM OCCURRED IN FLIGHT AND DOES NOT SHOW UP ON GROUND, PROCEED THRU BLOCK 11 IN ALL CASES WITH STRICT ADHERENCE TO PROBE HEATER RESISTANCE CHECKS.

/2\ ALWAYS CHECK PROBE HEATER RESISTANCES BEFORE CHANGING THE ADC.

AS/M Problems
Figure 104 (Sheet 3)

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S: 1E4, 1ER1, 188, 1827, 2A6
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
ADC SYSTEM 1 SHOWN; ADC SYSTEM 2 SHOWN IN PARENTHESIS
SET ALL SERVOED ALTIMETERS TO LOCAL BAROMETRIC PRESSURE

VSI PROBLEMS

1 DOES CAPT (F/O) VSI READ OTHER THAN 0 FPM? ALTITUDE ANNUNCIATION ON INSTRUMENT COMPARATOR PANELS MAY OR MAY NOT BE IN VIEW.
- YES → 6 DEPRESS CAPT ALTN ALT SWITCHLIGHT. DO VSIs BOTH READ 0 FPM?
  - YES → 12 REPLACE ADC NO. 1 (MM34-14-01).
  - NO → 7 RELEASE CAPT ALTN ALT SWITCHLIGHT. DEPRESS F/O ALTN ALT SWITCHLIGHT. DO VSIs BOTH READ 0 FPM?
    - YES → 13 REPLACE ADC NO. 2 (MM34-14-01).
    - NO → 14 REPLACE VSI THAT DOES NOT READ 0 FPM (MM34-14-09).
- NO

2 DOES CAPT (F/O) VSI POINTER STICK AT ZERO? OFF FLAG MAY BE IN VIEW. (1)
- YES → 8 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DOES OFF FLAG DISAPPEAR AND POINTER OPERATE NORMALLY?
  - YES → 15 REPLACE ADC NO. 1 (2) (MM34-14-01).
  - NO → 16 REPLACE CAPT (F/O) VSI (MM34-14-05).
- NO

3 DOES CAPT (F/O) VSI POINTER STICK AT ZERO WITH NO FLAG IN VIEW?
- YES → 9 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DOES POINTER OPERATE NORMALLY?
  - NO → 16 REPLACE CAPT (F/O) VSI (MM34-14-05).
  - YES → 17 REPLACE ADC NO. 1 (2) (MM34-14-01).
- NO

4 DOES CAPT (F/O) VSI POINTER STICK, OR IS IT INOPERATIVE? ALTITUDE ANNUNCIATION ON INSTRUMENT COMPARATOR PANELS AND OFF FLAG ON VSI MAY OR MAY NOT BE IN VIEW.
- YES → 10 DEPRESS CAPT (F/O) ALTN ALT SWITCHLIGHT. DOES POINTER OPERATE NORMALLY?
  - YES → 18 REPLACE ADC NO. 1 (2) (MM34-14-01). IF ALTITUDE ANNUNCIATION DOES NOT DISAPPEAR, TROUBLESHOOT INSTRUMENT COMPARISON MONITOR SYSTEM (MM34-18-00).
  - NO → 19 REPLACE CAPT (F/O) VSI (MM34-14-05).
- NO

5 DOES CAPT (F/O) VSI HAVE INTERMITTENT FLAG, BUT APPARENTLY NORMAL OPERATION?
- YES → 11 SELECT ALTN ALT. DOES FLAG STAY OUT OF VIEW?
  - NO → 19 REPLACE CAPT (F/O) VSI (MM34-14-05).
  - YES → 20 REPLACE ADC NO. 1 (NO. 2) (MM34-14-01).
- NO

TO SHEET 2

NOTE

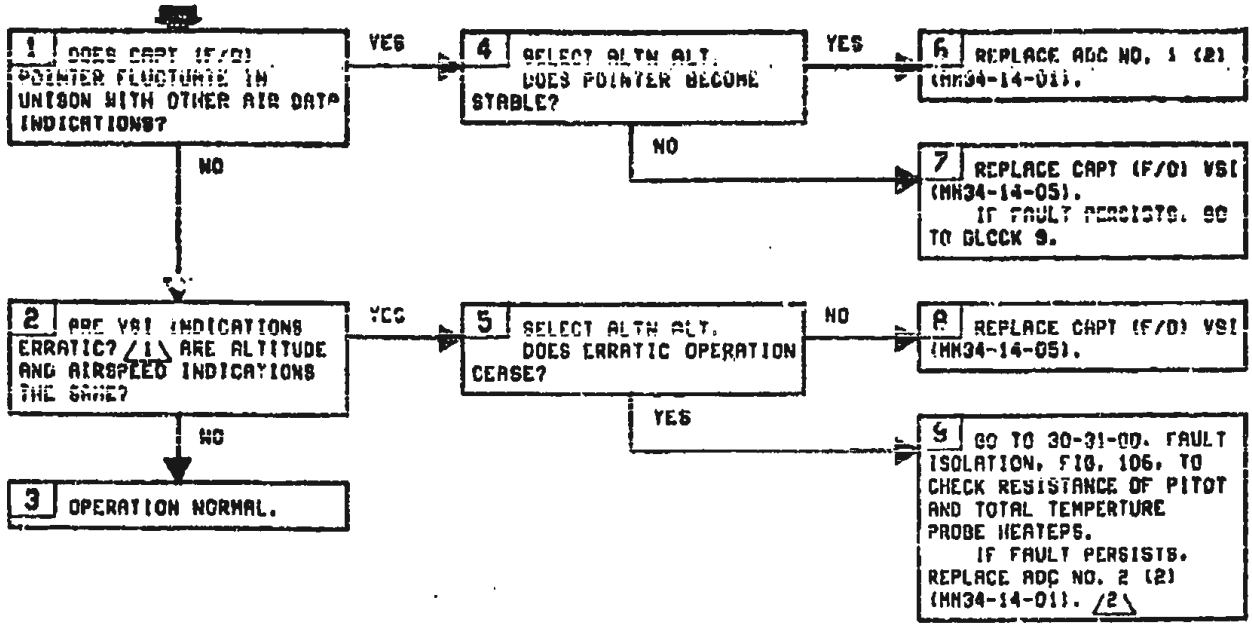
(1) STEP 2 ONWARD REQUIRES USING A PITOT-STATIC TESTER. EXCEPTION, STEP 5

M1-0000-00-1001

VSI Problems
Figure 105 (Sheet 1)

PREREQUISITES
SEE SHEET 1

FROM SHEET 1


1 DOES CAPT (F/O) POINTER FLUCTUATE IN UNISON WITH OTHER AIR DATA INDICATIONS?
YES
4 SELECT ALTN ALT. DOES POINTER BECOME STABLE?
YES
6 REPLACE ADC NO. 1 (2) (MM34-14-01).
NO
7 REPLACE CAPT (F/O) VSI (MM34-14-05). IF FAULT PERSISTS, GO TO BLOCK 9.
NO
2 ARE VSI INDICATIONS ERRATIC? /1\ ARE ALTITUDE AND AIRSPEED INDICATIONS THE SAME?
YES
5 SELECT ALTN ALT. DOES ERRATIC OPERATION CEASE?
NO
8 REPLACE CAPT (F/O) VSI (MM34-14-05).
YES
9 GO TO 30-31-00, FAULT ISOLATION, FIG. 106, TO CHECK RESISTANCE OF PITOT AND TOTAL TEMPERTURE PROBE HEATERS. IF FAULT PERSISTS, REPLACE ADC NO. 2 (2) (MM34-14-01). /2\
NO
3 OPERATION NORMAL.

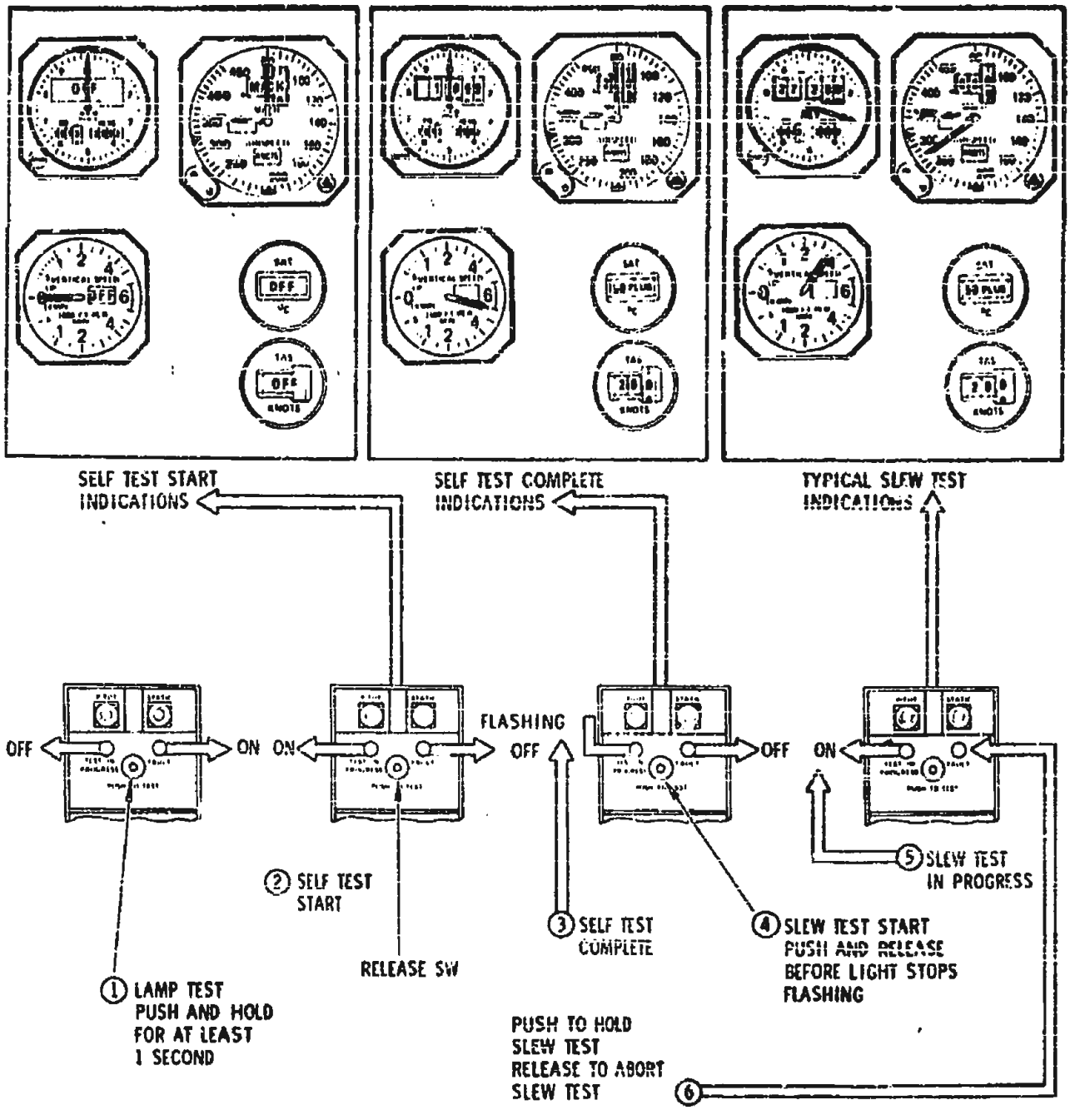
NOTE

/1\ IF THIS PROBLEM OCCURED IN FLIGHT AND DOES NOT SHOW UP ON GROUND, PROCEED THRU BLOCK 9 IN ALL CASES WITH STRICT ADHERENCE TO PROBE HEATER RESISTANCE CHECKS IN 30-31-00.

/2\ ALWAYS CHECK HEATER RESISTANCES BEFORE ATTEMPTING TO CHANGE ADC.

M1-0002-34-2B53

VSI Problems
Figure 105 (Sheet 2)



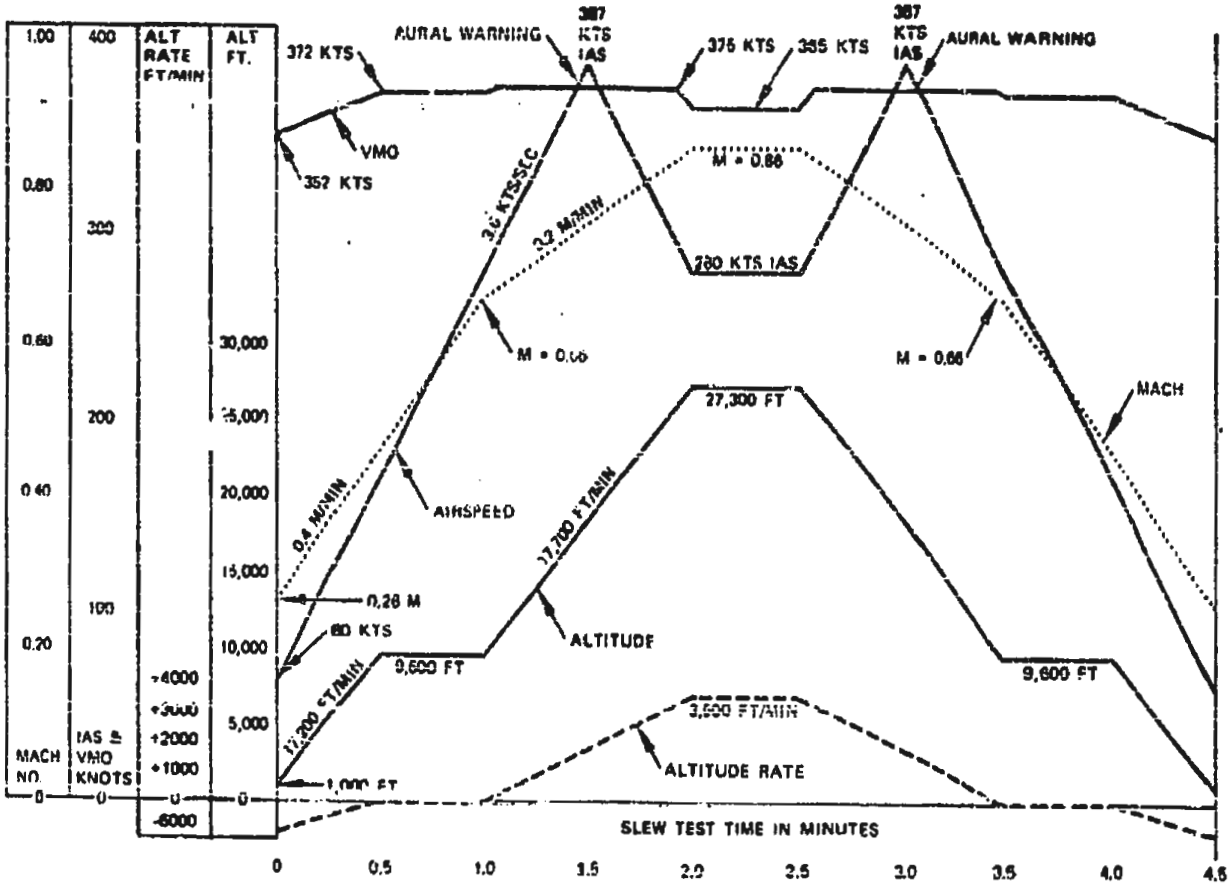
MI-0001-34-978

CR
CR

DADC Self-Test Procedure
Figure 106 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH
DIGITAL AIR DATA COMPUTER

001B



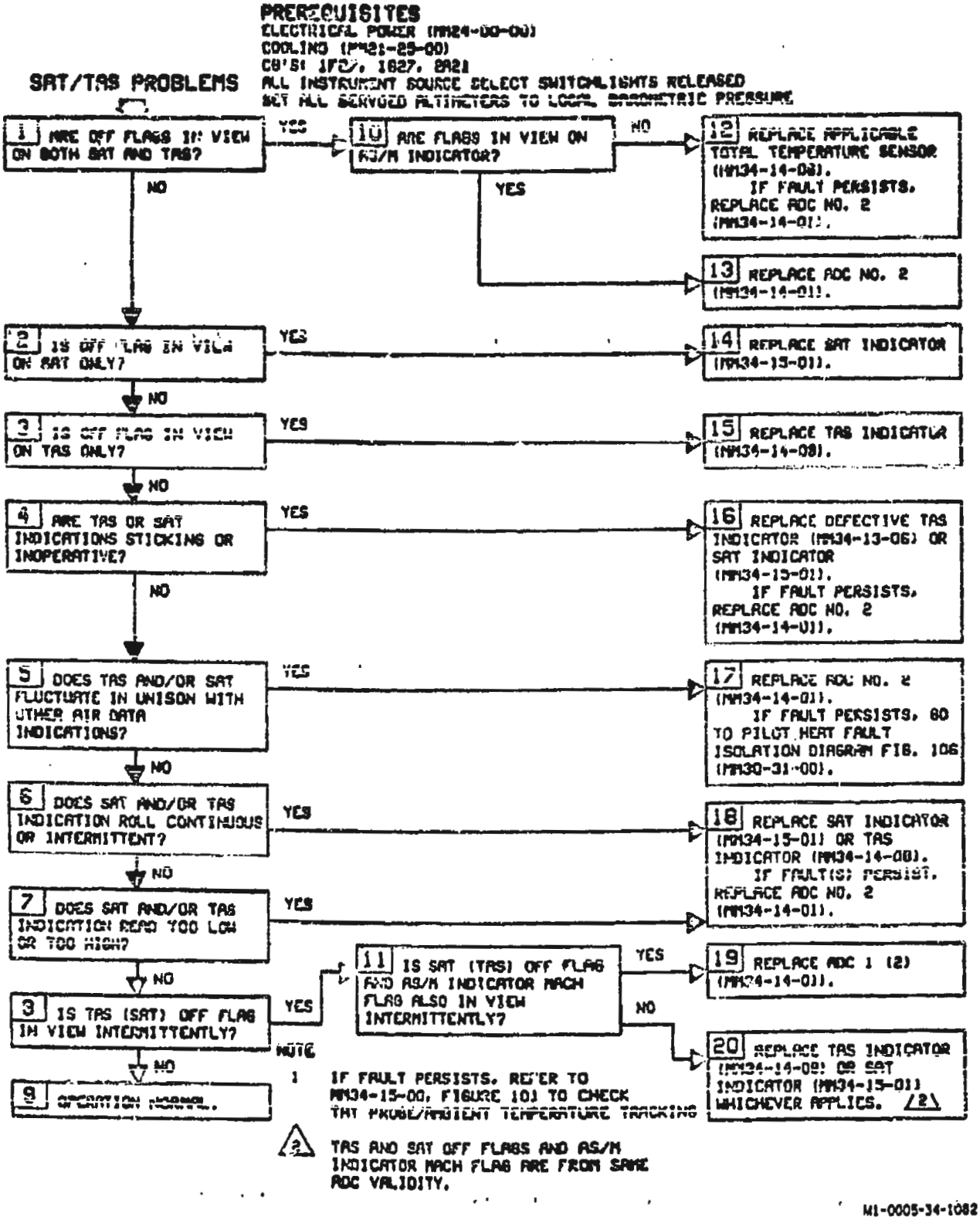
M1-0000-34-002

R
CR
CR

DADC Self-Test Procedure
Figure 106 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH
DIGITAL AIR DATA COMPUTER

001B


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S 1F7, 1B27, 8N21
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
SET ALL SERVOED ALTIMETERS TO LOCAL BAROMETRIC PRESSURE
SAT/TAS PROBLEMS
1 ARE OFF FLAGS IN VIEW ON BOTH SAT AND TAS?
YES
10 ARE FLAGS IN VIEW ON AS/M INDICATOR?
NO
12 REPLACE APPLICABLE TOTAL TEMPERATURE SENSOR (MM34-14-08). IF FAULT PERSISTS, REPLACE ADC NO. 2 (MM34-14-01).
YES
13 REPLACE ADC NO. 2 (MM34-14-01).
NO
2 IS OFF FLAG IN VIEW ON SAT ONLY?
YES
14 REPLACE SAT INDICATOR (MM34-15-01).
NO
3 IS OFF FLAG IN VIEW ON TAS ONLY?
YES
15 REPLACE TAS INDICATOR (MM34-14-08).
NO
4 ARE TAS OR SAT INDICATIONS STICKING OR INOPERATIVE?
YES
16 REPLACE DEFECTIVE TAS INDICATOR (MM34-13-06) OR SAT INDICATOR (MM34-15-01). IF FAULT PERSISTS, REPLACE ADC NO. 2 (MM34-14-01).
NO
5 DOES TAS AND/OR SAT FLUCTUATE IN UNISON WITH OTHER AIR DATA INDICATIONS?
YES
17 REPLACE ADC NO. 2 (MM34-14-01). IF FAULT PERSISTS, GO TO PILOT HEAT FAULT ISOLATION DIAGRAM FIG. 106 (MM30-31-00).
NO
6 DOES SAT AND/OR TAS INDICATION ROLL CONTINUOUS OR INTERMITTENT?
YES
18 REPLACE SAT INDICATOR (MM34-15-01) OR TAS INDICATOR (MM34-14-08). IF FAULT(S) PERSIST, REPLACE ADC NO. 2 (MM34-14-01).
NO
7 DOES SAT AND/OR TAS INDICATION READ TOO LOW OR TOO HIGH?
YES
NO
8 IS TAS (SAT) OFF FLAG IN VIEW INTERMITTENTLY?
YES
11 IS SAT (TAS) OFF FLAG AND AS/M INDICATOR MACH FLAG ALSO IN VIEW INTERMITTENTLY?
YES
19 REPLACE ADC 1 (2) (MM34-14-01).
NO
20 REPLACE TAS INDICATOR (MM34-14-08) OR SAT INDICATOR (MM34-15-01) WHICHEVER APPLIES. /2\
NO
9 OPERATION NORMAL.
NOTE
1 IF FAULT PERSISTS, REFER TO MM34-15-00, FIGURE 101 TO CHECK THAT PROBE/AMBIENT TEMPERATURE TRACKING
/2\ TAS AND SAT OFF FLAGS AND AS/M INDICATOR MACH FLAG ARE FROM SAME ADC VALIDITY.

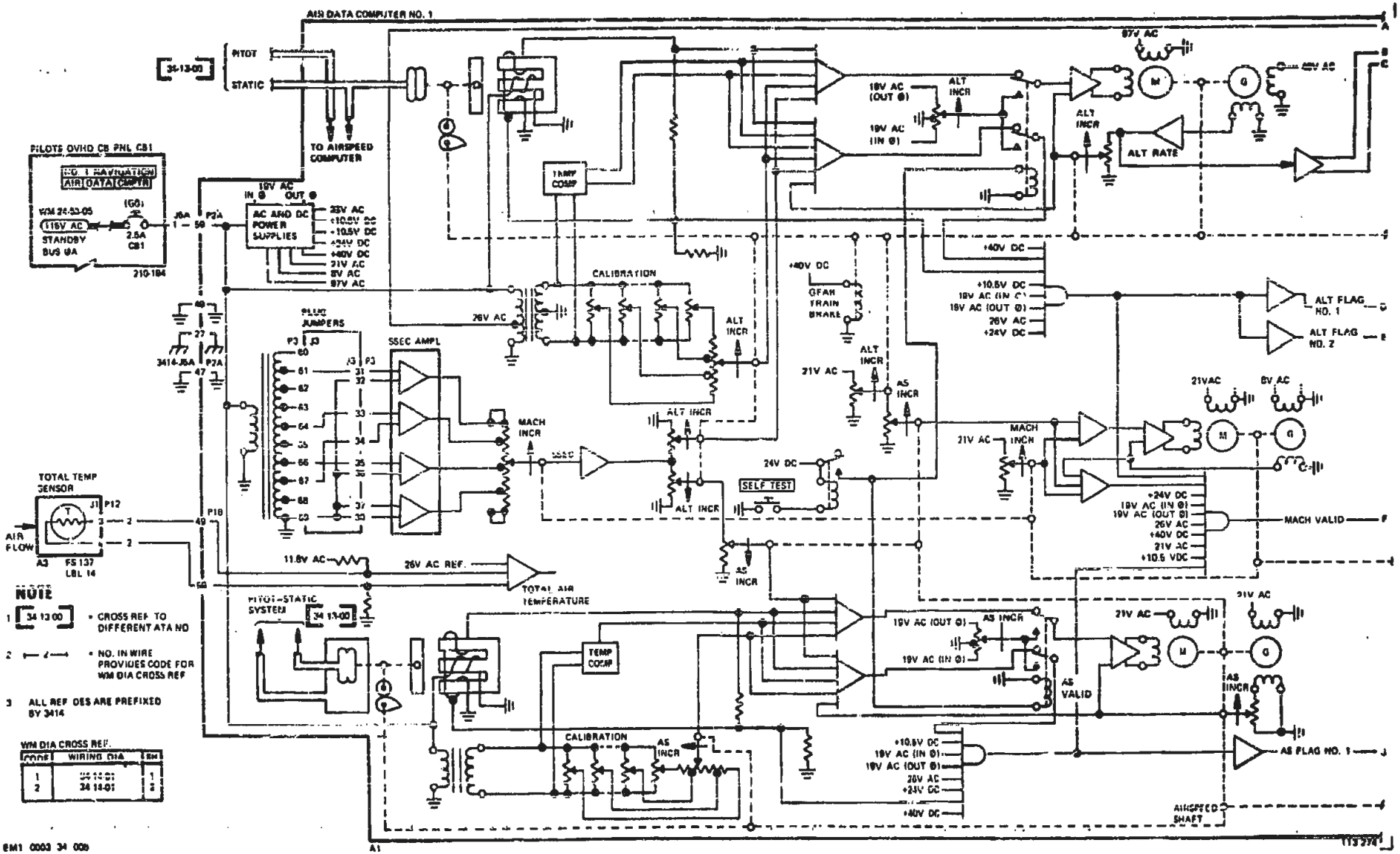
M1-0005-34-1082

R
R

SAT/TAS Problems
Figure 107

EFFECTIVITY: ALL

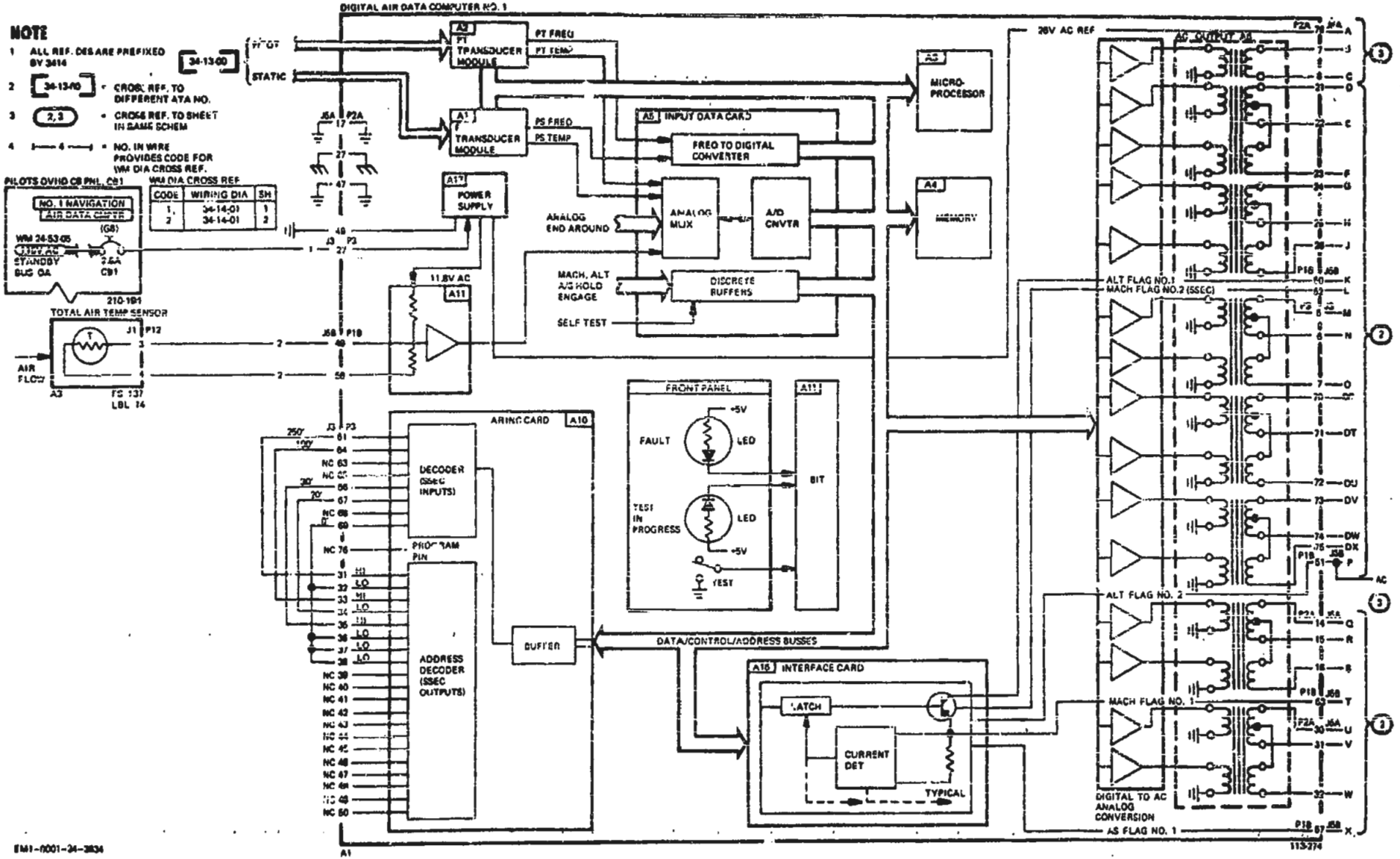
001B



R ADC System Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

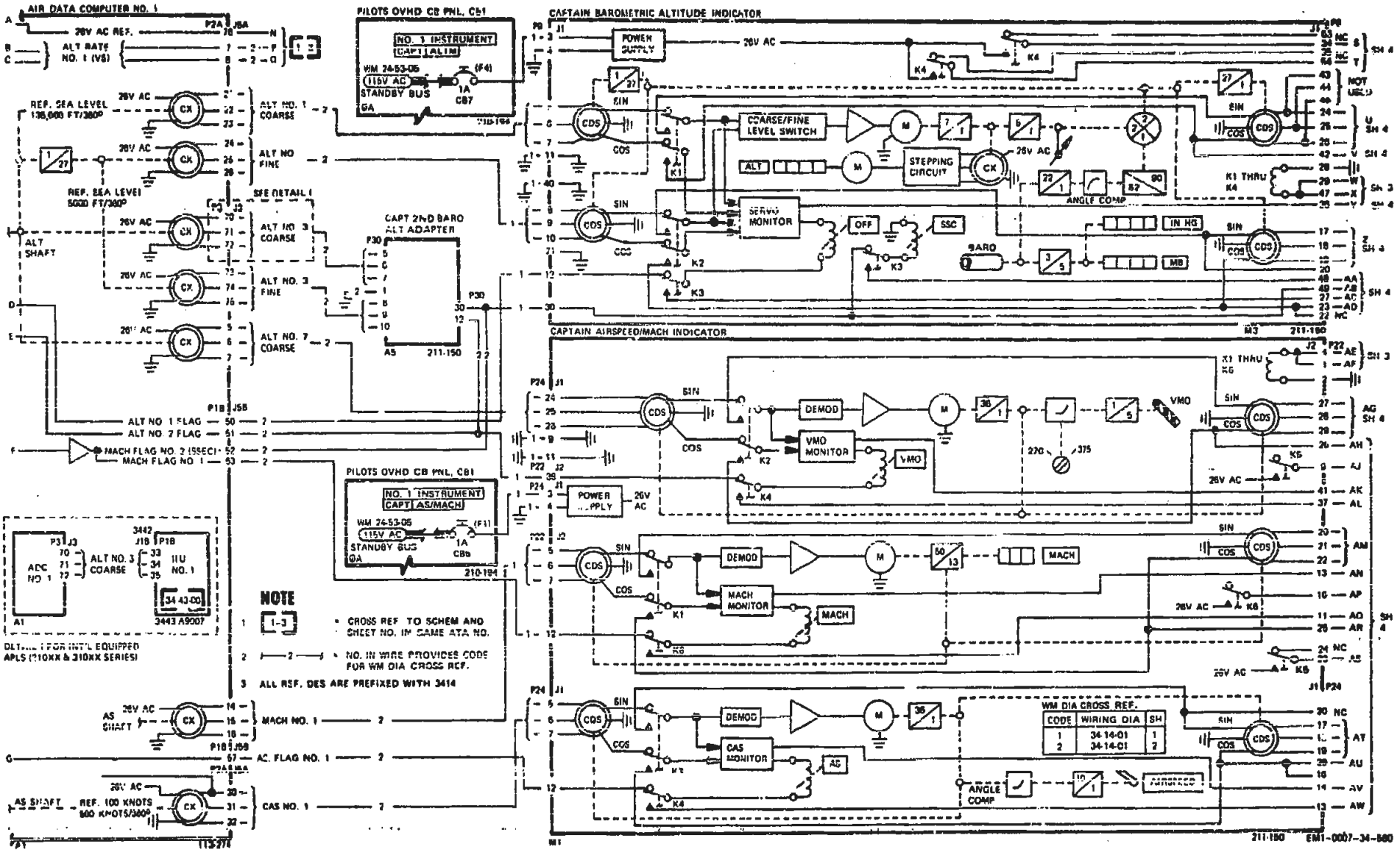
001B



R ADC System Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

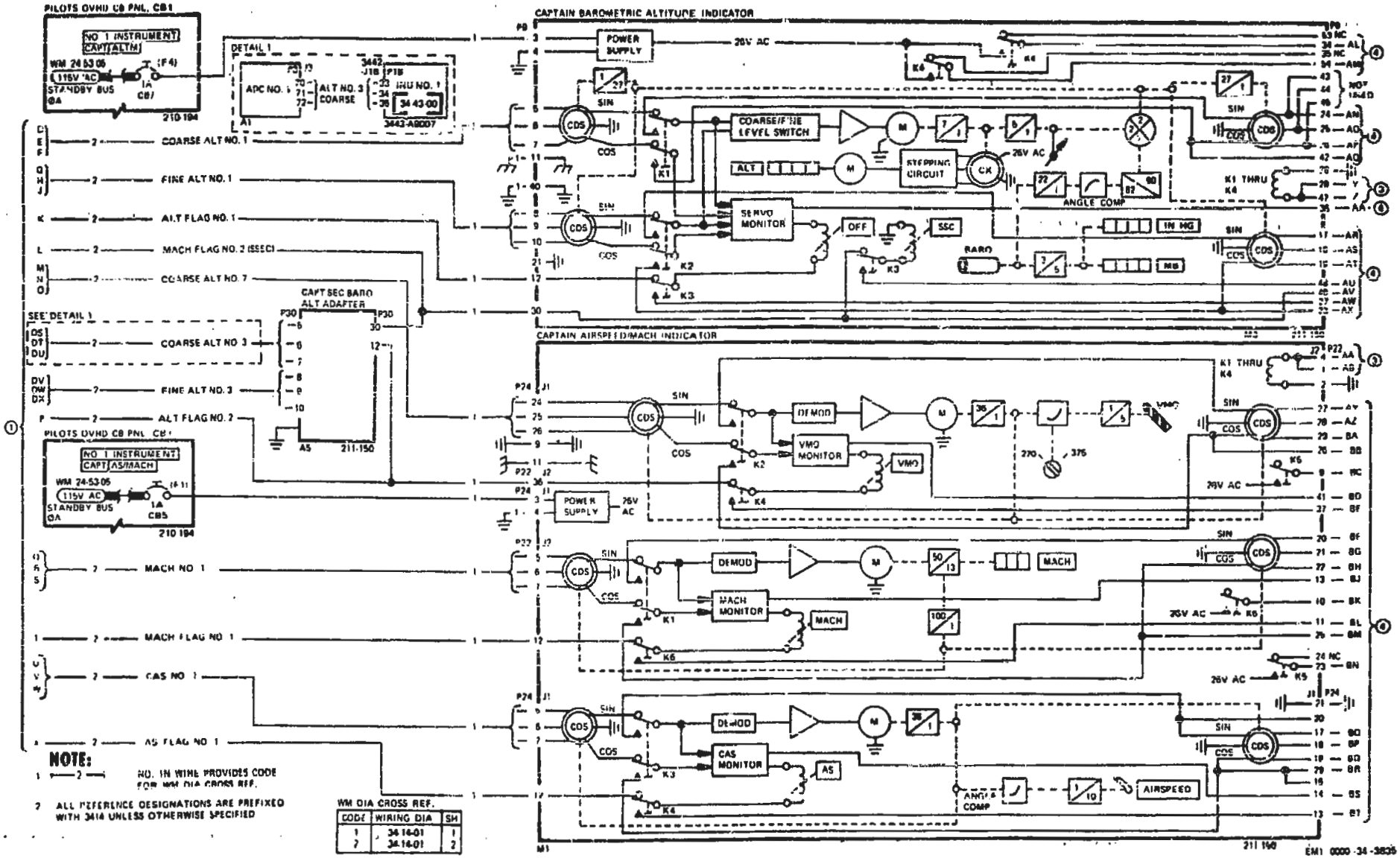
001B


AIR DATA COMPUTER NO. 1
CAPTAIN BAROMETRIC ALTITUDE INDICATOR
CAPTAIN AIRSPEED/MACH INDICATOR
PILOTS OVHD CB PNL, C51
NO. 1 INSTRUMENT CAPT ALTM
NO. 1 INSTRUMENT CAPT AS/MACH
CAPT 2ND BARO ALT ADAPTER
ALT NO. 1 COARSE
ALT NO. 1 FINE
ALT NO. 3 COARSE
ALT NO. 3 FINE
ALT NO. 2 COARSE
ALT NO 1 FLAG
ALT NO 2 FLAG
MACH FLAG NO. 2 (SSEC)
MACH FLAG NO. 1
MACH NO. 1
AC. FLAG NO. 1
CAS NO. 1
COARSE/FINE LEVEL SWITCH
STEPPING CIRCUIT
SERVO MONITOR
VMO MONITOR
MACH MONITOR
CAS MONITOR
ANGLE COMP
DEMOD
POWER SUPPLY
NOTE
1 CROSS REF TO SCHEM AND SHEET NO. IN SAME ATA NO.
2 NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
3 ALL REF. DES ARE PREFIXED WITH 3414
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 34-14-01 | 1
2 | 34-14-01 | 2

R ADC System Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

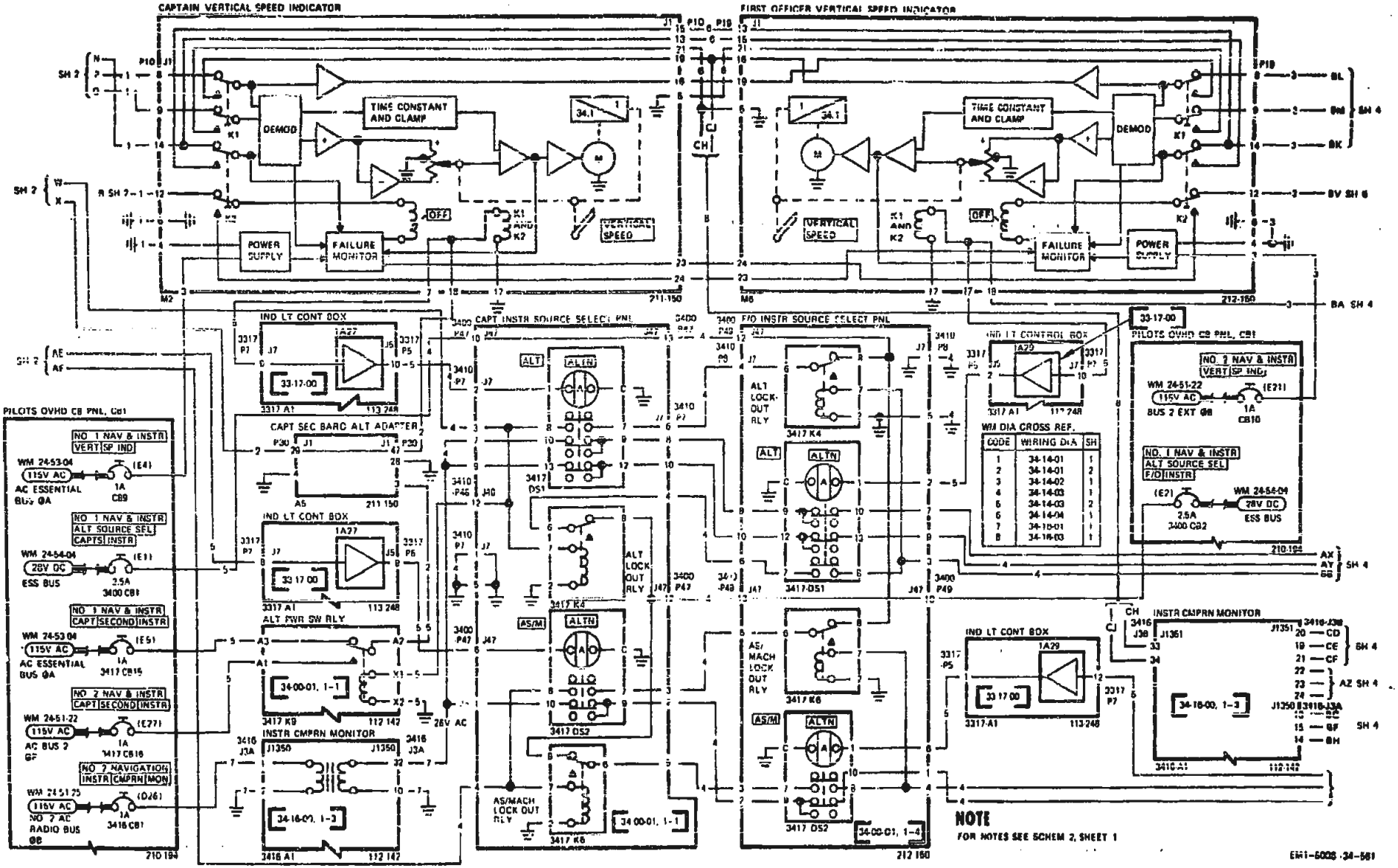
001B



R
R ADC System Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

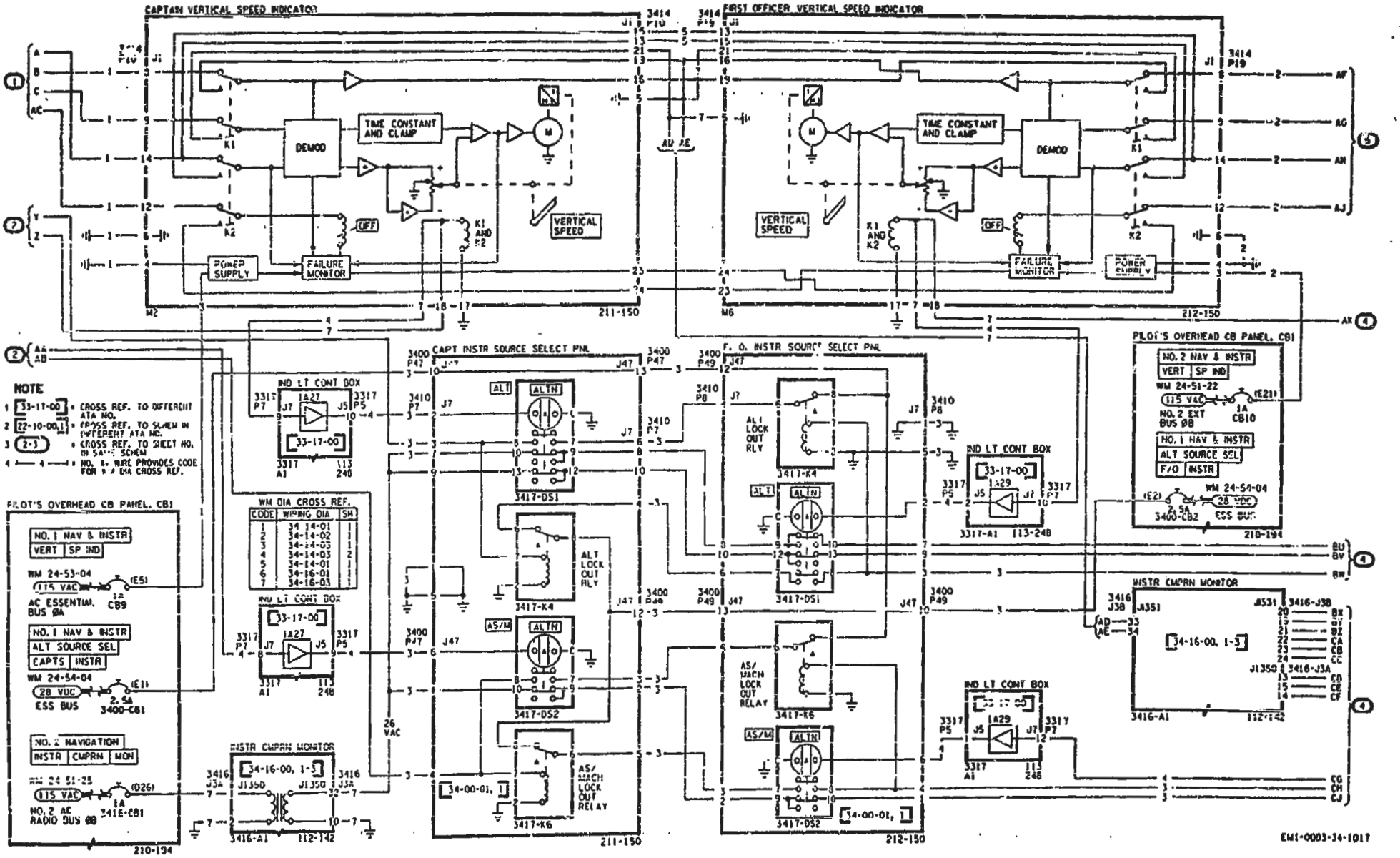
001B


CAPTAIN VERTICAL SPEED INDICATOR
FIRST OFFICER VERTICAL SPEED INDICATOR
DEMOD
TIME CONSTANT AND CLAMP
POWER SUPPLY
FAILURE MONITOR
OFF
VERTICAL SPEED
K1 AND K2
IND LT CONT BOX
CAPT INSTR SOURCE SELECT PNL
F/O INSTR SOURCE SELECT PNL
CAPT SEC BARO ALT ADAPTER
ALT PWR SW RLY
ALT LOCK OUT RLY
AS/MACH LOCK OUT RLY
INSTR CMPRN MONITOR
PILOTS OVHD CB PNL, CB1
NO 1 NAV & INSTR VERT SP IND
NO 1 NAV & INSTR ALT SOURCE SEL CAPTS INSTR
NO 1 NAV & INSTR CAPT SECOND INSTR
NO 2 NAV & INSTR CAPT SECOND INSTR
NO 2 NAVIGATION INSTR CMPRN MON
NO 1 NAV & INSTR ALT SOURCE SEL F/O INSTR
NO 2 NAV & INSTR VERT SP IND
WM DIA CROSS REF.
CODE
WIRING DIA
SH
AC ESSENTIAL BUS @A
ESS BUS
AC BUS 2 @F
NO 2 AC RADIO BUS @B
BUS 2 EXT @B
28V AC
28V DC
115V AC
2.5A
1A
NOTE
FOR NOTES SEE SCHEM 2, SHEET 1

R ADC System Schematic
R SCHEM 1 (Sheet 3)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC .

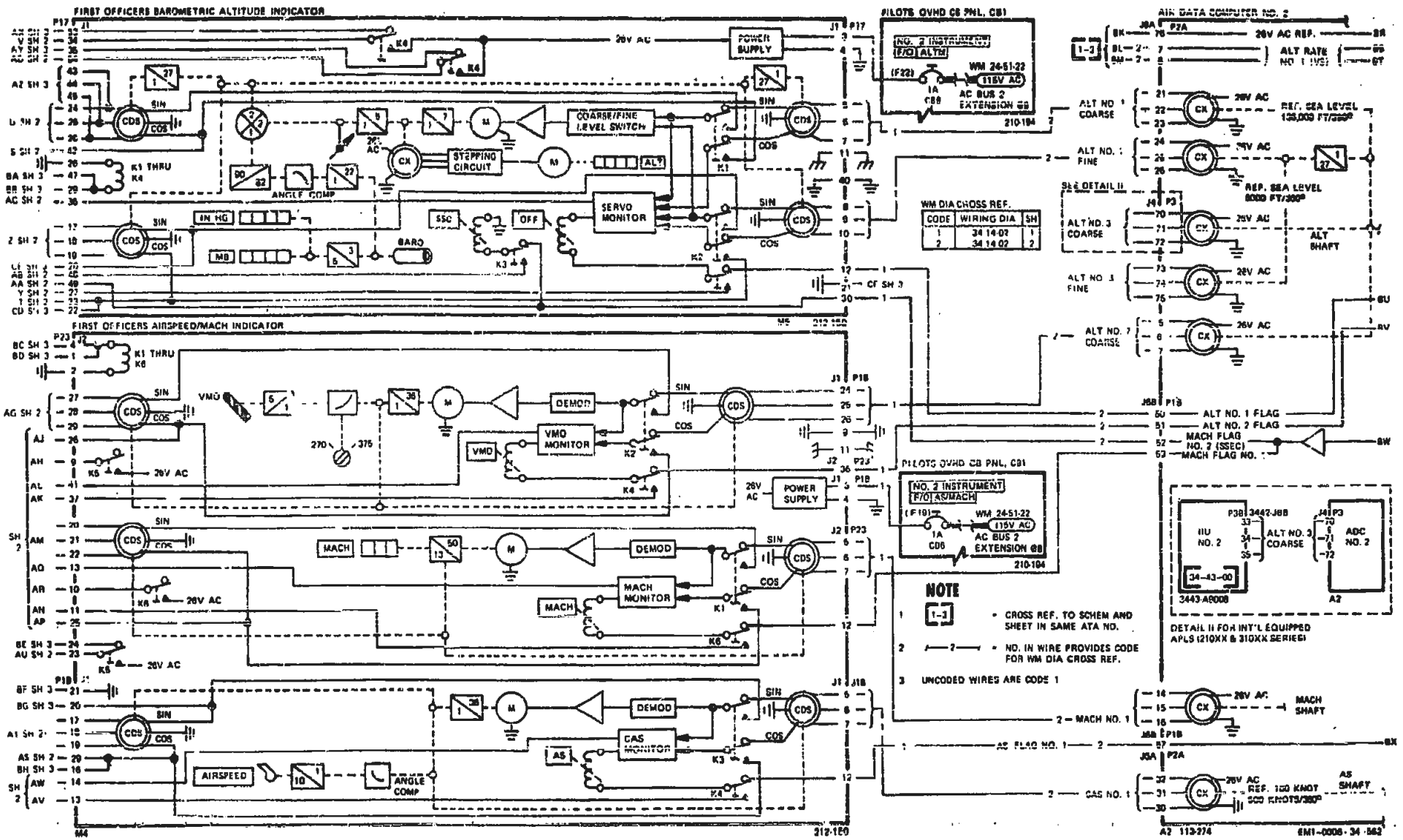
0018


CAPTAIN VERTICAL SPEED INDICATOR
FIRST OFFICER VERTICAL SPEED INDICATOR
TIME CONSTANT AND CLAMP
DEMOD
VERTICAL SPEED
POWER SUPPLY
FAILURE MONITOR
OFF
K1 AND K2
CAPT INSTR SOURCE SELECT PNL
F. O. INSTR SOURCE SELECT PNL
IND LT CONT BOX
WM DIA CROSS REF.
INSTR CMPRN MONITOR
PILOT'S OVERHEAD CB PANEL, CB1
NO. 1 NAV & INSTR
VERT SP IND
NO. 2 NAV & INSTR
ALT SOURCE SEL
CAPTS INSTR
F/O INSTR
NO. 2 NAVIGATION
INSTR CMPRN MON
ALT LOCK OUT RLY
AS/MACH LOCK OUT RELAY
NOTE
1 33-17-00 = CROSS REF. TO DIFFERENT ATA NO.
2 22-10-00,1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2-3 = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. 6 WIRE PROVIDES CODE FOR WIRE DIA CROSS REF.
EM1-0003-34-1017

R ADC System Schematic
R SCHEM 1 (Sheet 3)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

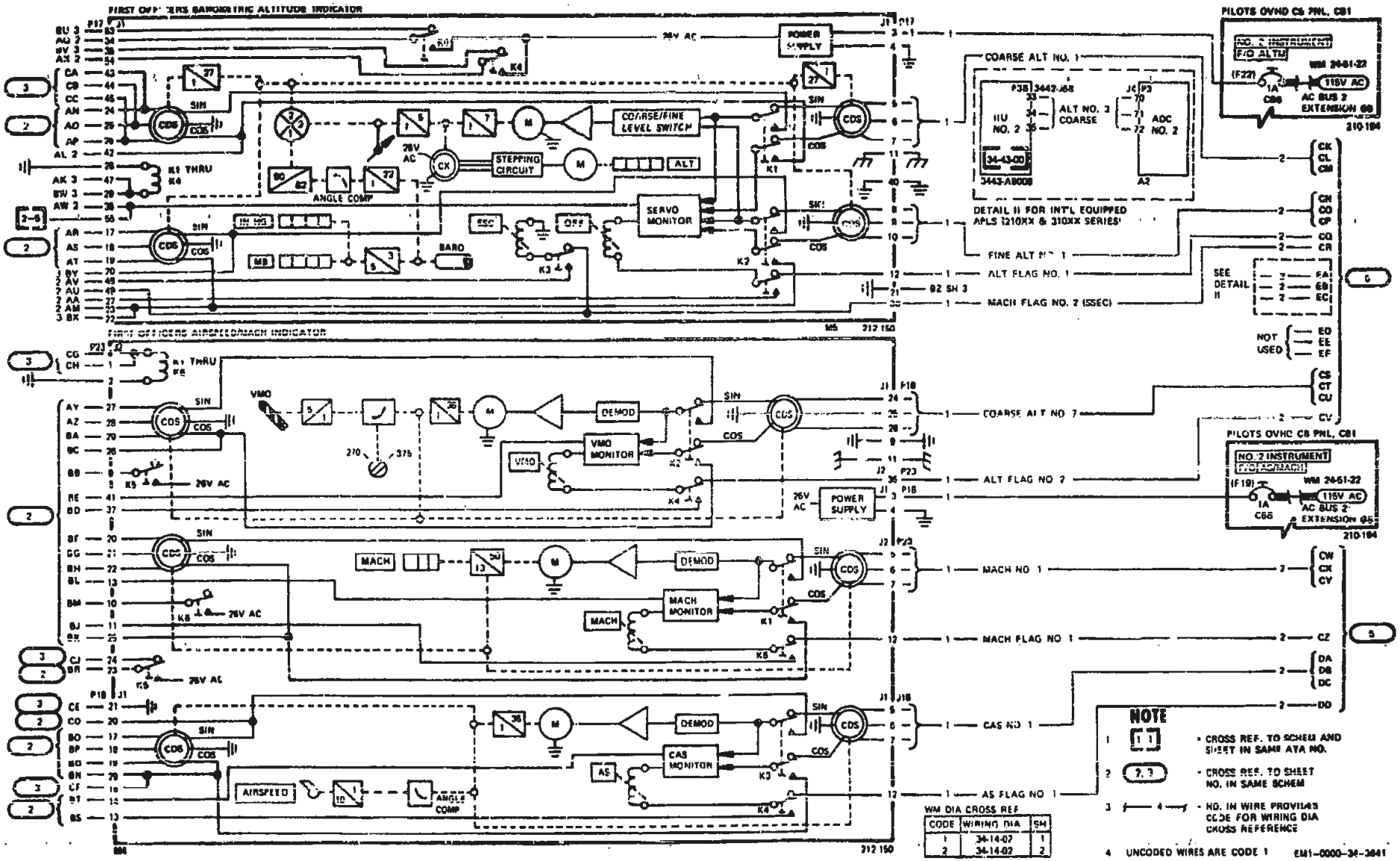
001B



R ADC System Schematic
R SCHEM 1 (Sheet 4)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

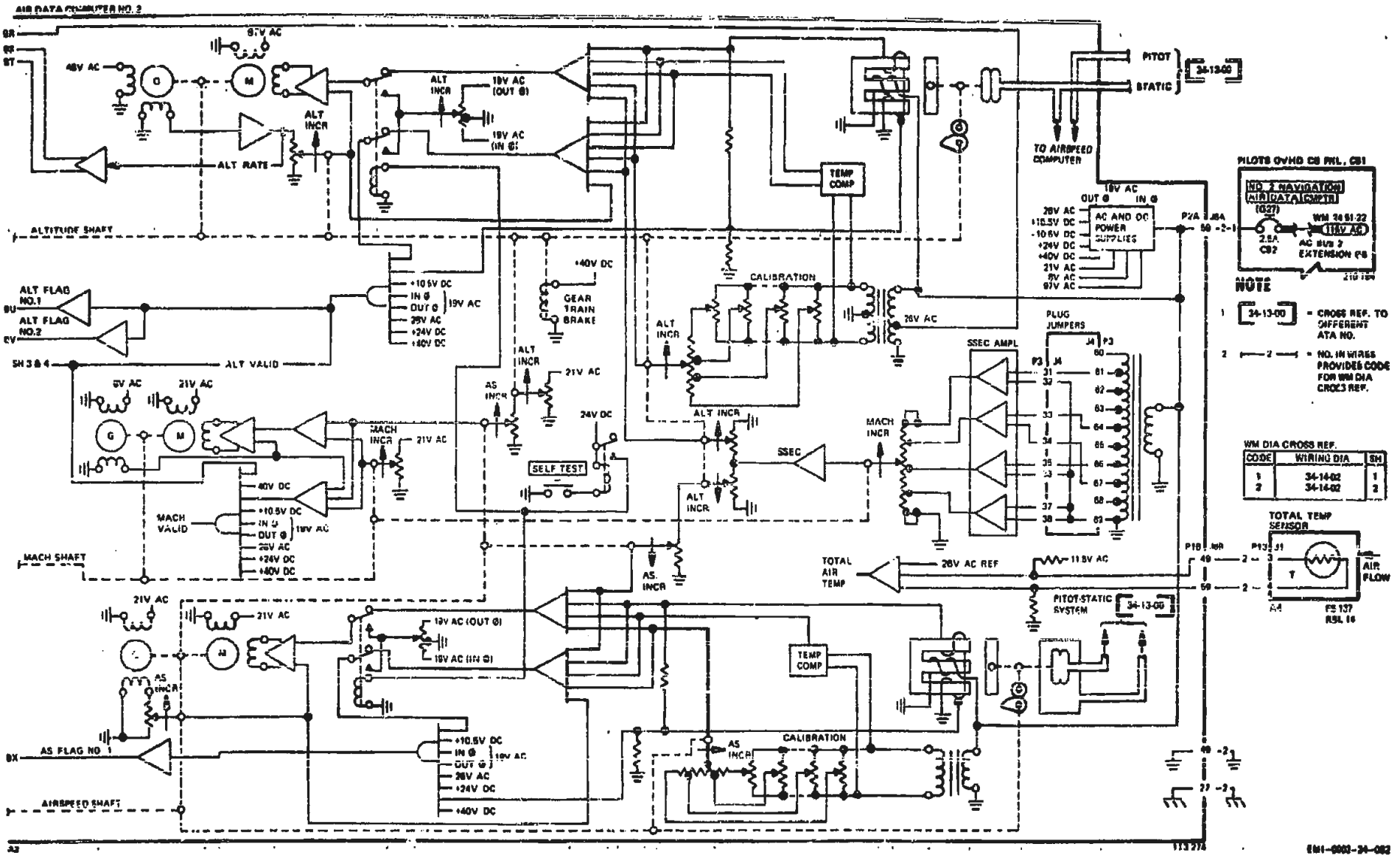
001B


FIRST OFFICERS GAIN/ERTIC ALTITUDE INDICATOR
FIRST OFFICERS AIRSPEED/MACH INDICATOR
PILOTS OVHD CB PNL, CB1
PILOTS OVHD CB PNL, CB1
COARSE ALT NO. 1
DETAIL II FOR INT'L EQUIPPED APLS (210XX & 310XX SERIES)
SEE DETAIL II
NOT USED
COARSE ALT NO. 2
ALT FLAG NO. 2
MACH NO. 1
MACH FLAG NO. 1
CAS NO. 1
AS FLAG NO. 1
WM DIA CROSS REF
CODE | WIRING DIA | SH
1 | 34-14-07 | 1
2 | 34-14-02 | 2
NOTE
1 · CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 · CROSS REF. TO SHEET NO. IN SAME SCHEM
3 · NO. IN WIRE PROVIDES CODE FOR WIRING DIA CROSS REFERENCE
4 UNCODED WIRES ARE CODE 1
EM1-0000-34-3841

R ADC System Schematic
R SCHEM 1 (Sheet 4)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

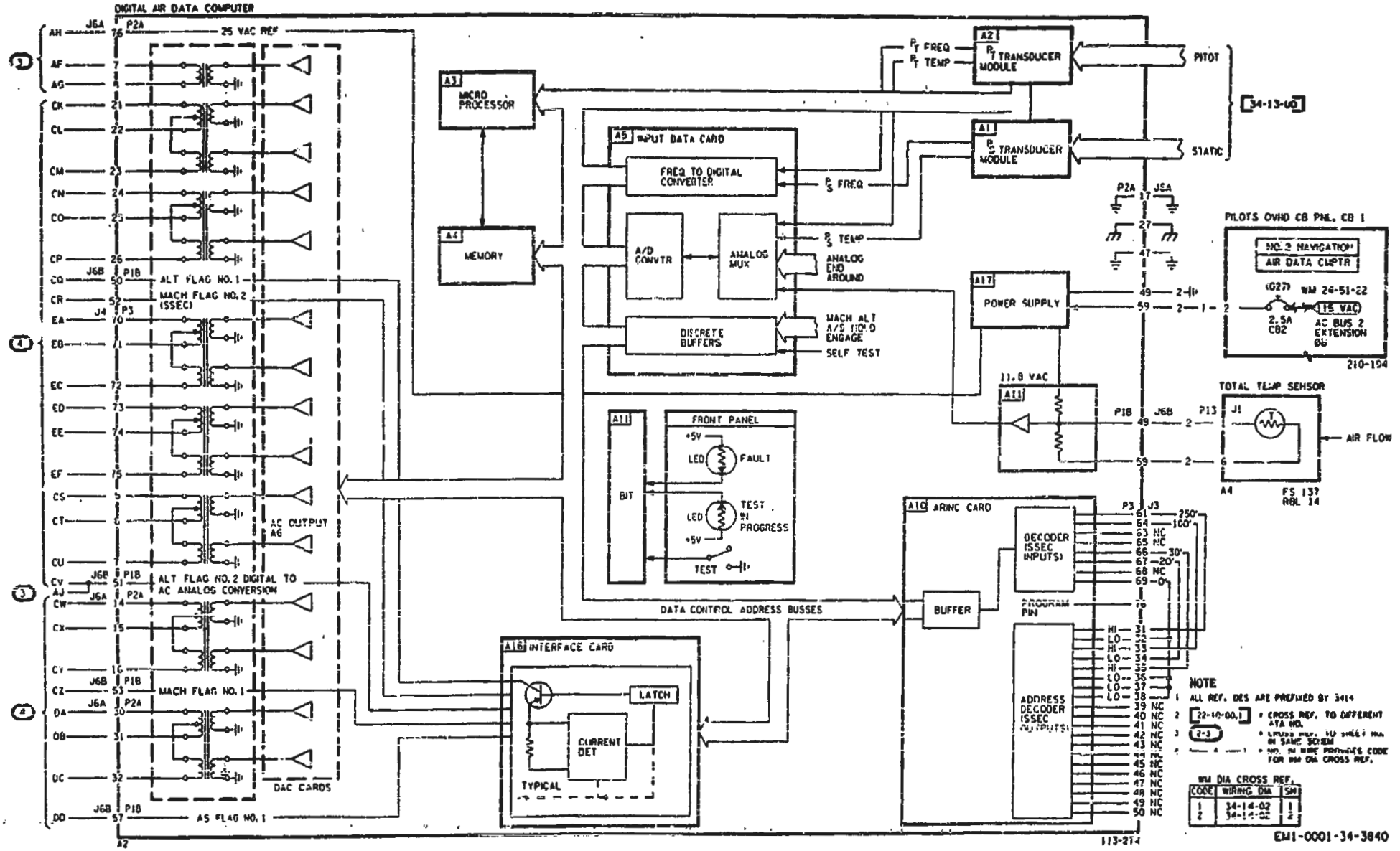
001B



R ADC System Schematic
R SCHEM 1 (Sheet 5)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

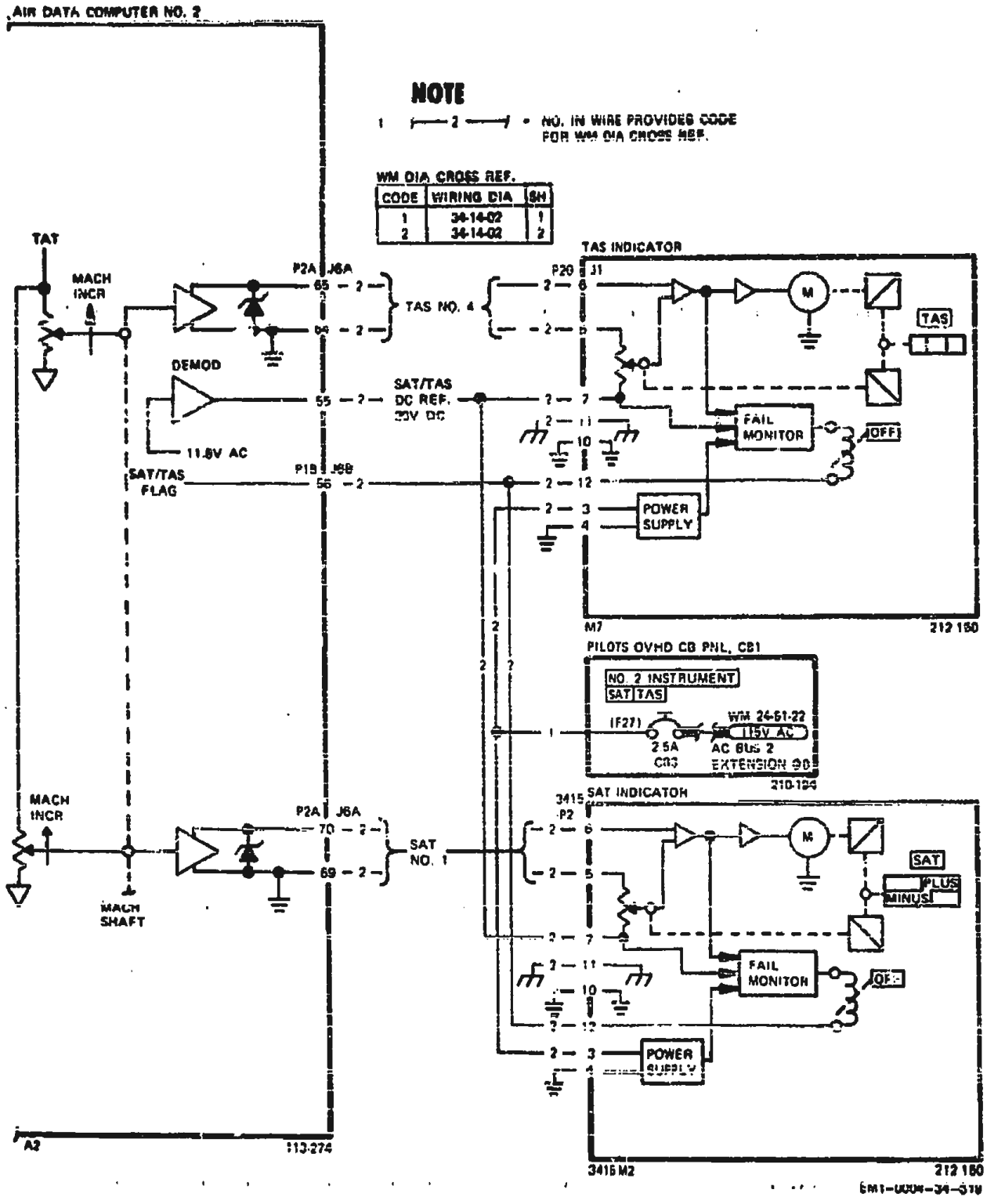
0018



R ADC System Schematic
R SCHEM 1 (Sheet 5)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

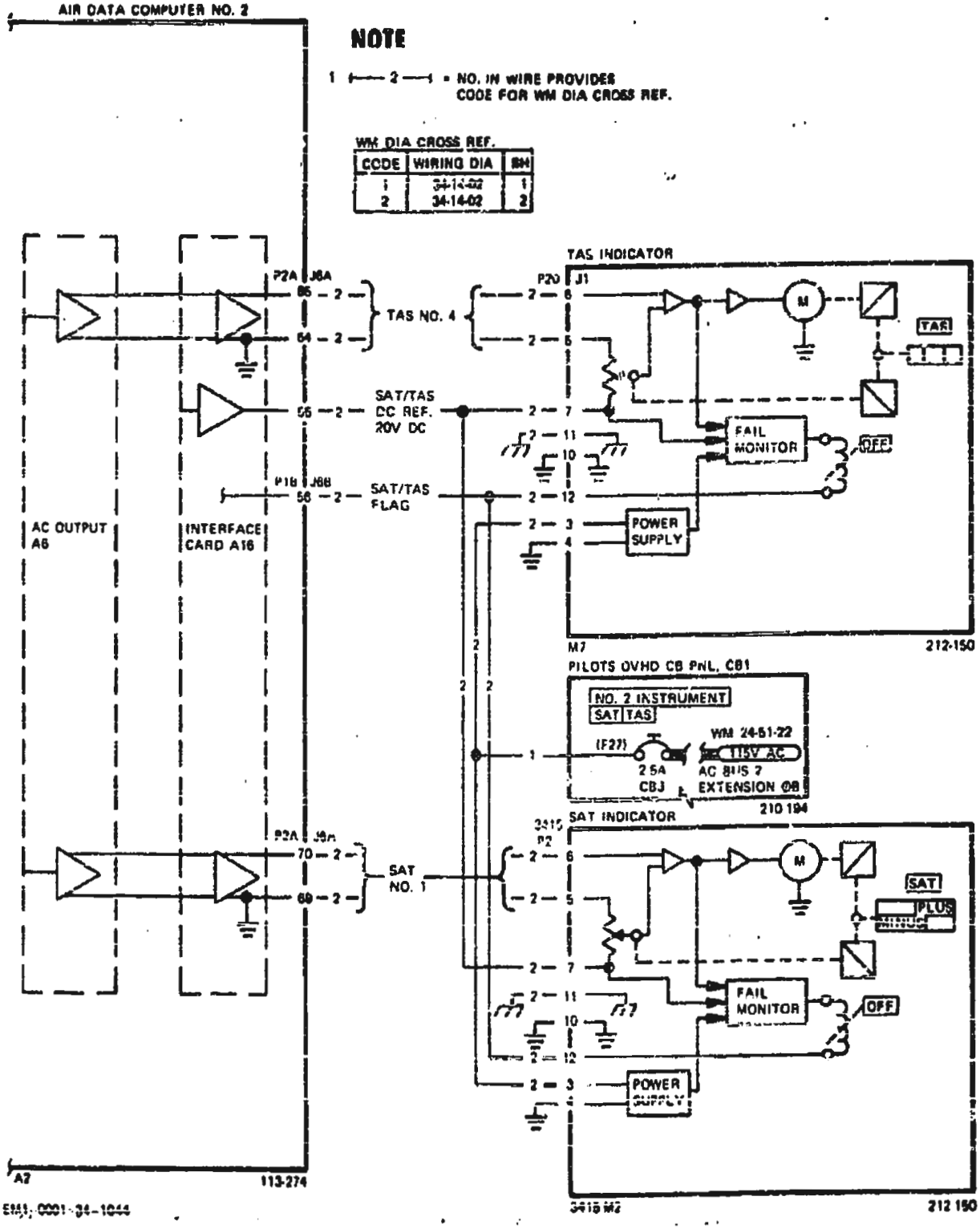
001B



R ADC System Schematic
R SCHEM 1 (Sheet 6)

R EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

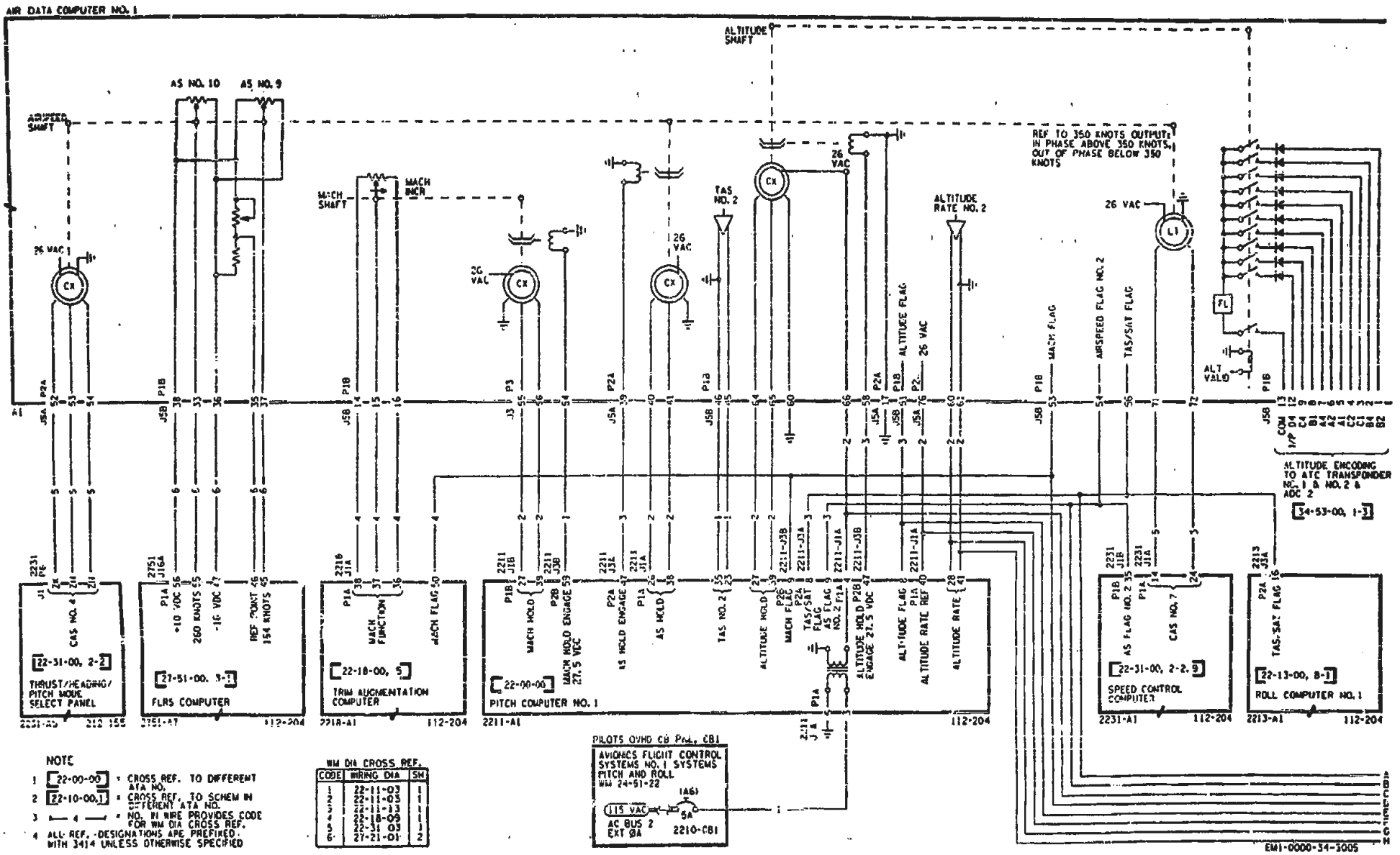
001B



R ADC System Schematic
R SCHEM 1 (Sheet 6)

R EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

001B



NOTE

1. [22-00-00] = CROSS REF. TO DIFFERENT ATA NO.
2. [22-10-00,1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. — 4 — = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4. ALL REF. -DESIGNATIONS ARE PREFIXED WITH 3414 UNLESS OTHERWISE SPECIFIED

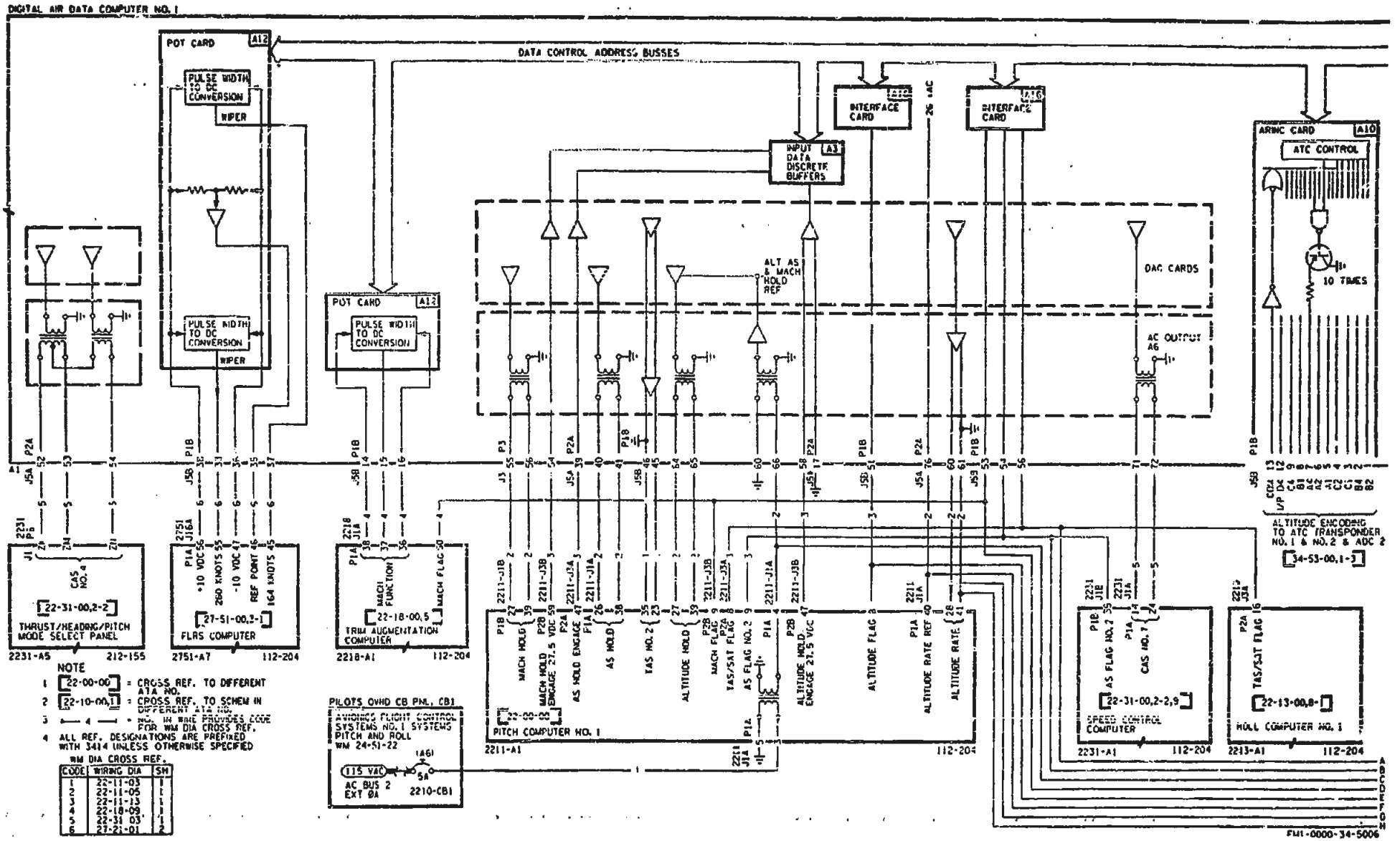
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-05	1
3	22-11-13	1
4	22-18-09	1
5	22-31-03	1
6	27-21-01	2

R Air Data Computer No. 1 Interface Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

001B

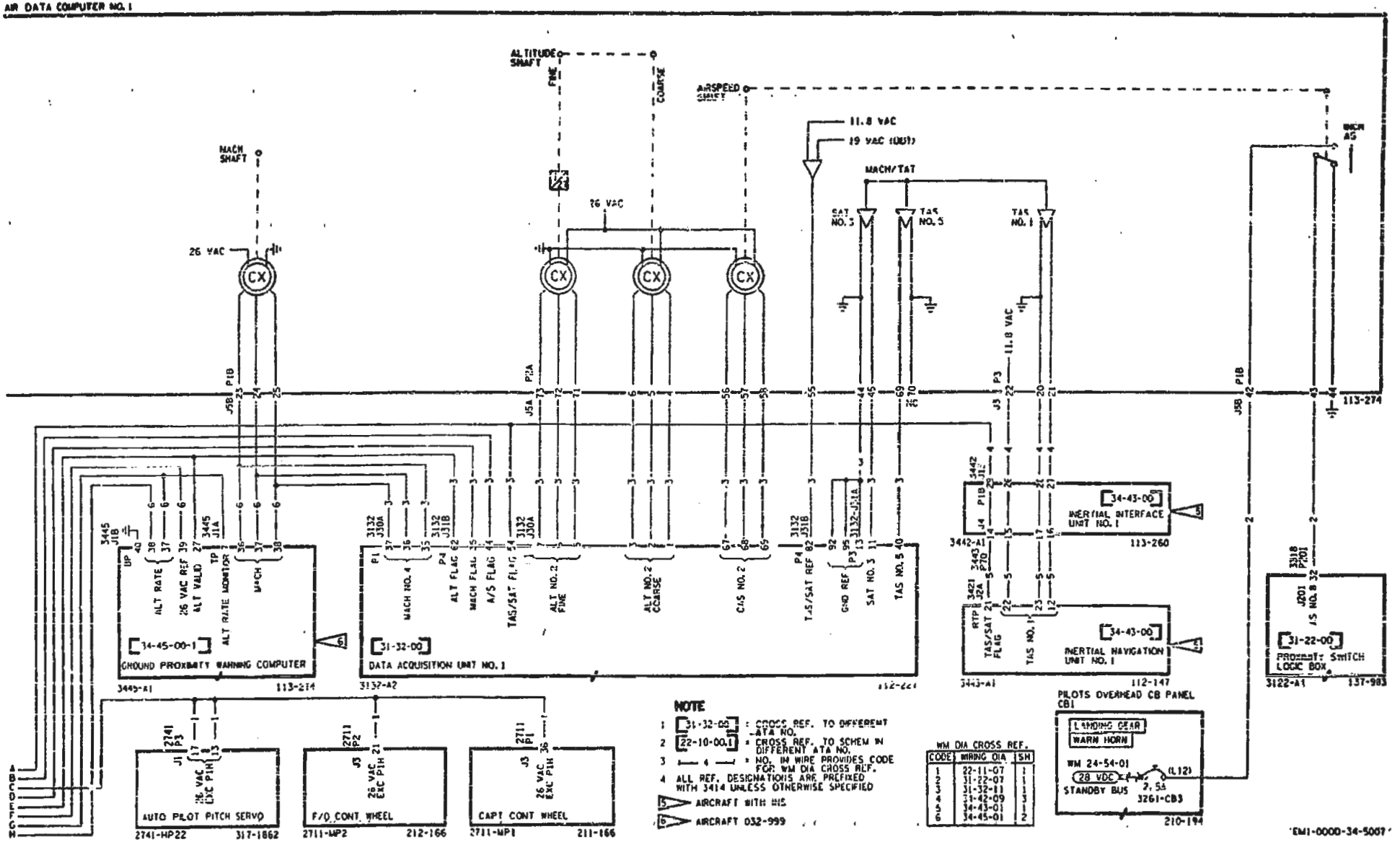


R Air Data Computer No. 1 Interface Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

001B

AIR DATA COMPUTER NO. 1

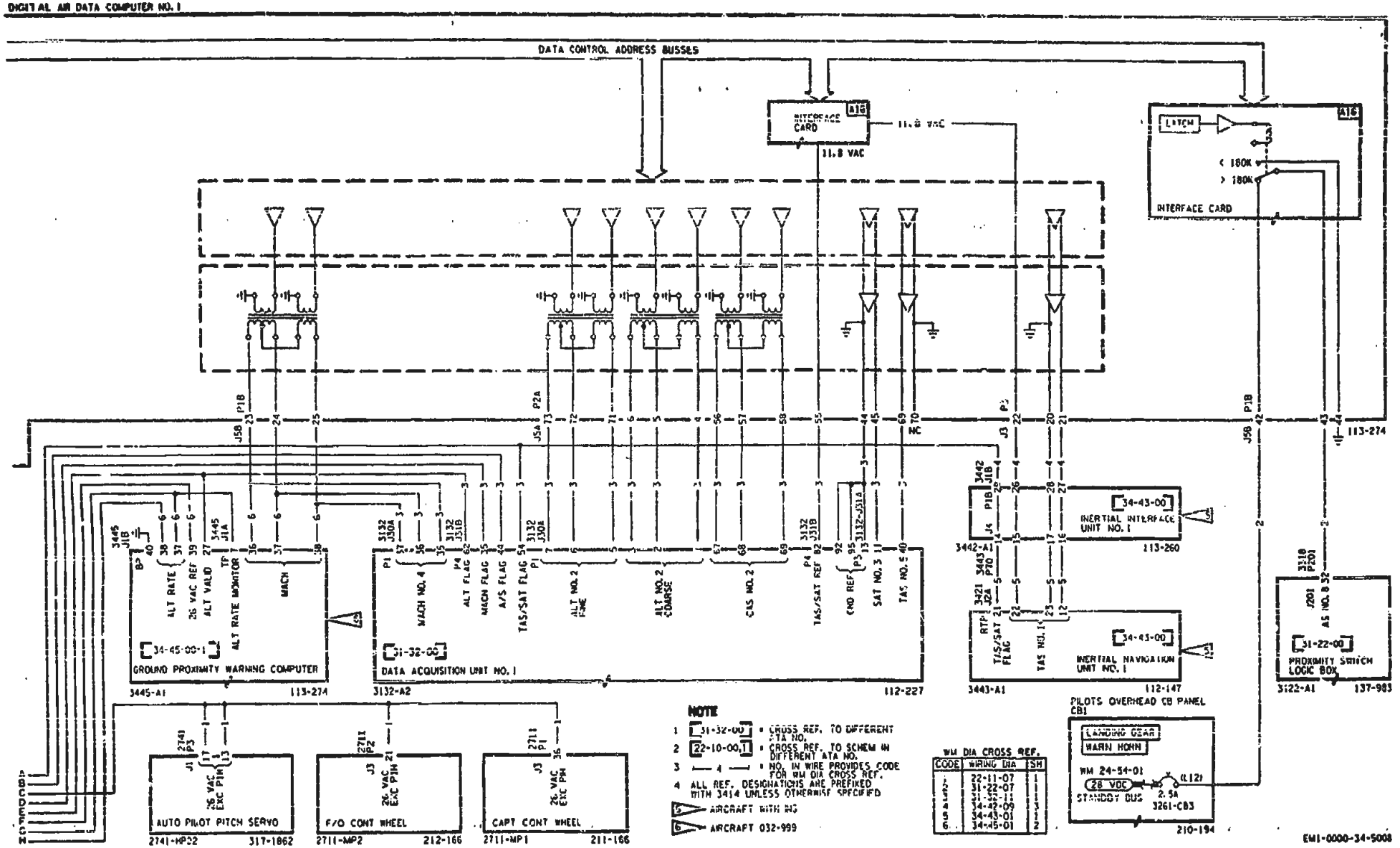


R Air Data Computer No. 1 Interface Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

001B

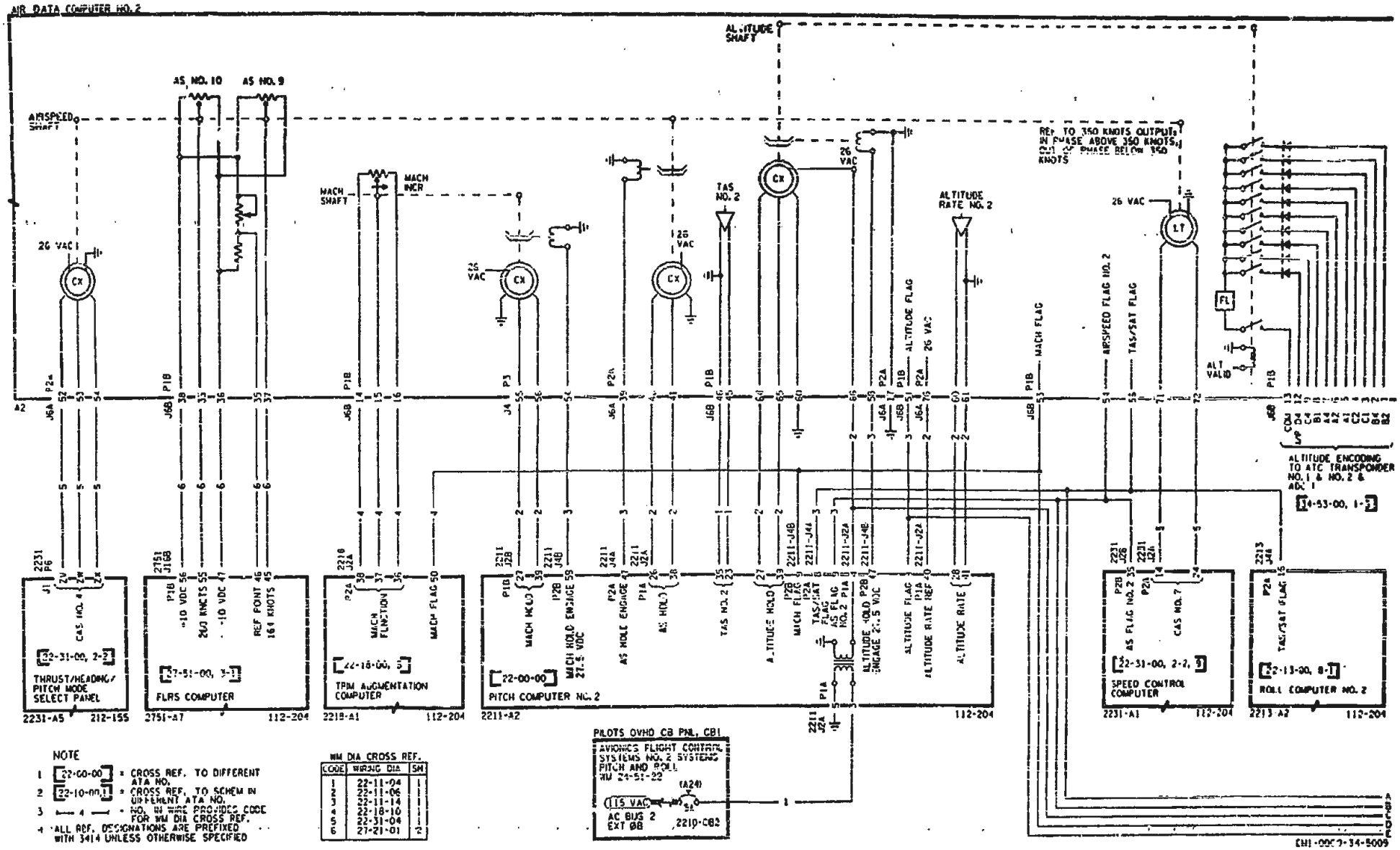
DIGITAL AIR DATA COMPUTER NO. 1



R Air Data Computer No. 1 Interface Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

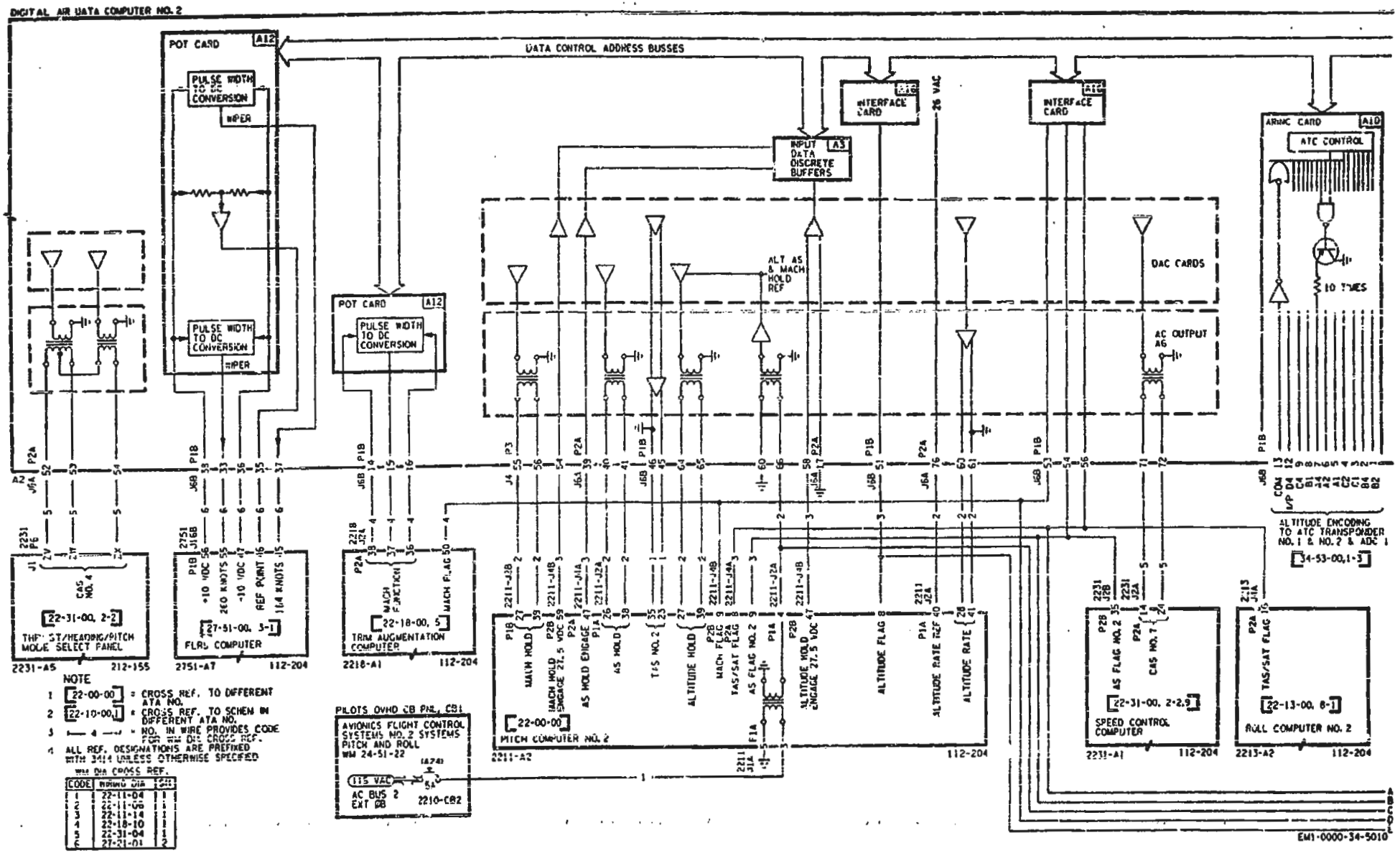
001B


AIR DATA COMPUTER NO. 2
AIRSPEED SHAFT
AS NO. 10
AS NO. 9
MACH SHAFT
MACH INCR
ALTITUDE SHAFT
TAS NO. 2
ALTITUDE RATE NO. 2
26 VAC
REF TO 350 KNOTS OUTPUTS IN PHASE ABOVE 350 KNOTS, 121 OUT OF PHASE BELOW 350 KNOTS
ALTITUDE FLAG
AIRSPEED FLAG NO. 2
TAS/SAT FLAG
MACH FLAG
ALT VALID
ALTITUDE ENCODING TO ATC TRANSPONDER NO. 1 & NO. 2 & ADC 1
THRUST/HEADING/ PITCH MODE SELECT PANEL
FLRS COMPUTER
TRIM AUGMENTATION COMPUTER
PITCH COMPUTER NO. 2
SPEED CONTROL COMPUTER
ROLL COMPUTER NO. 2
PILOTS OVHD CB PNL, CB1
AVIONICS FLIGHT CONTROL SYSTEMS NO. 2 SYSTEMS PITCH AND ROLL
AC BUS 2 EXT ØB
115 VAC
NOTE
1 [22-60-00] = CROSS REF. TO DIFFERENT ATA NO.
2 [22-10-00] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 — 4 — = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 ALL REF. DESIGNATIONS ARE PREFIXED WITH 3414 UNLESS OTHERWISE SPECIFIED
WM DIA CROSS REF.
CODE | WIRING DIA | SM
5 | 22-11-04, 22-11-06, 22-11-14, 22-18-16, 22-31-04 | 1
6 | 27-21-01 | 2

R Air Data Computer No. 2 Interface Schematic
R SCHEM 3 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

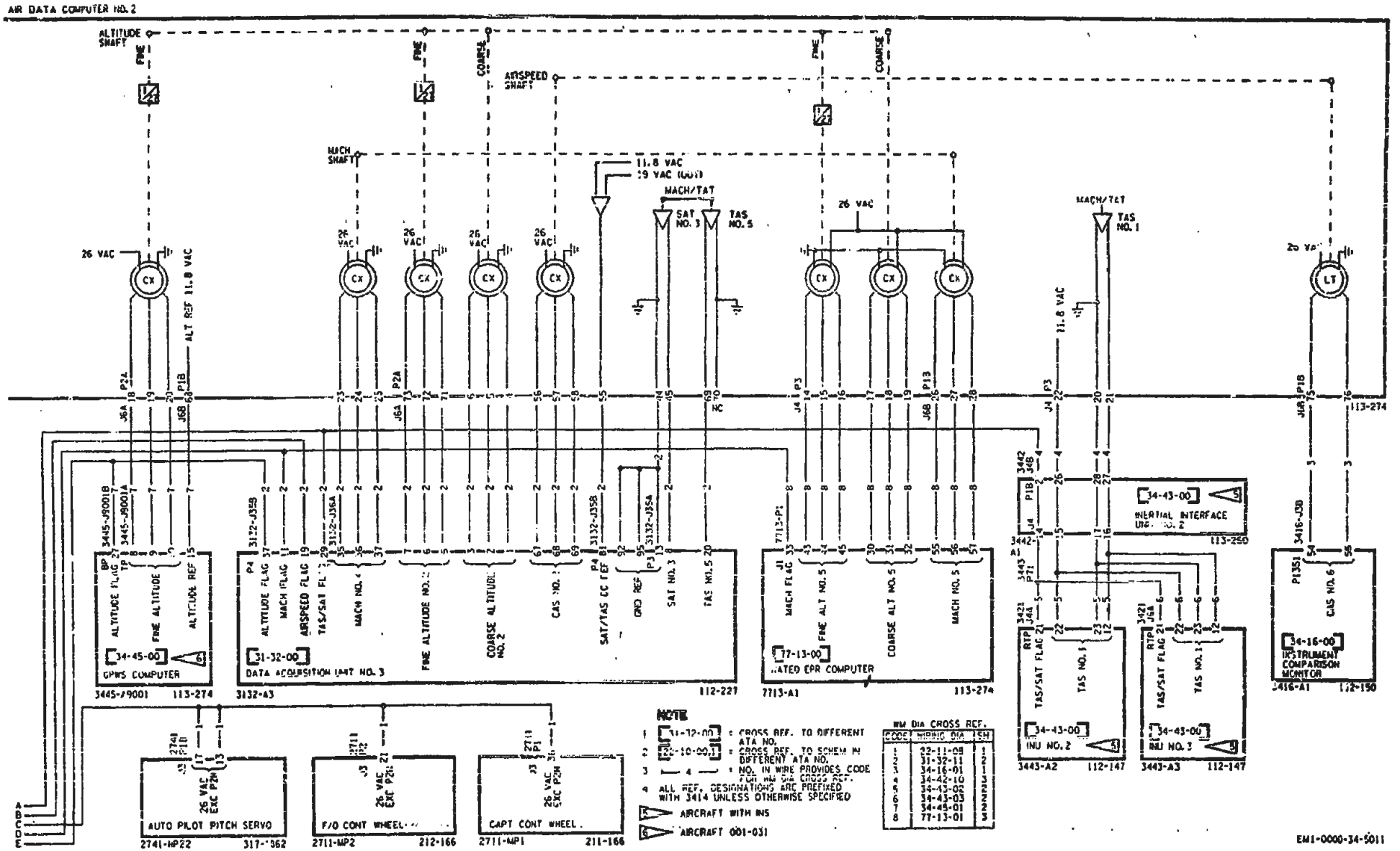
001B



R Air Data Computer No. 2 Interface Schematic
R SCHEM 3 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

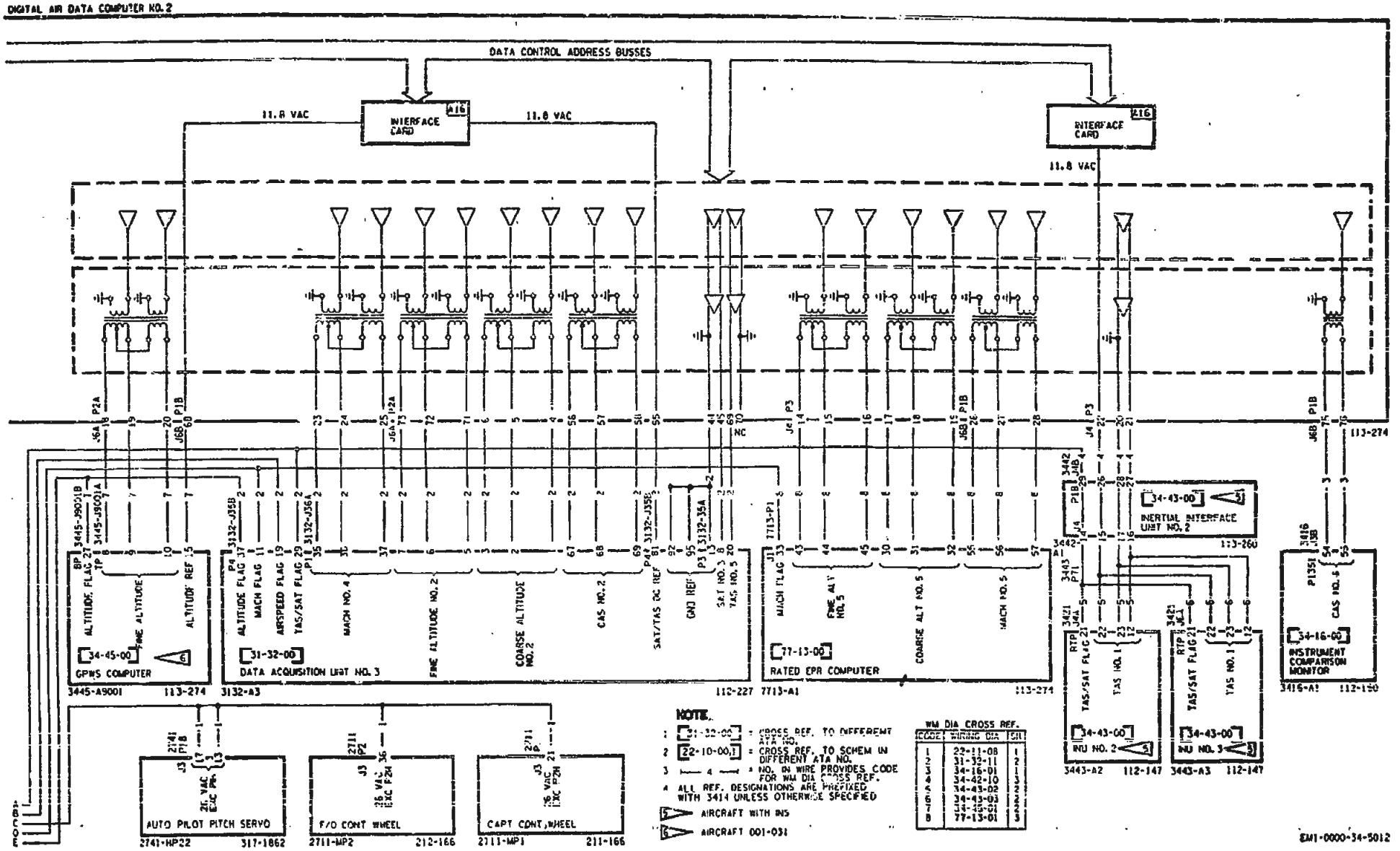
001B



R Air Data Computer No. 2 Interface Schematic
R SCHEM 3 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH ANALOG ADC

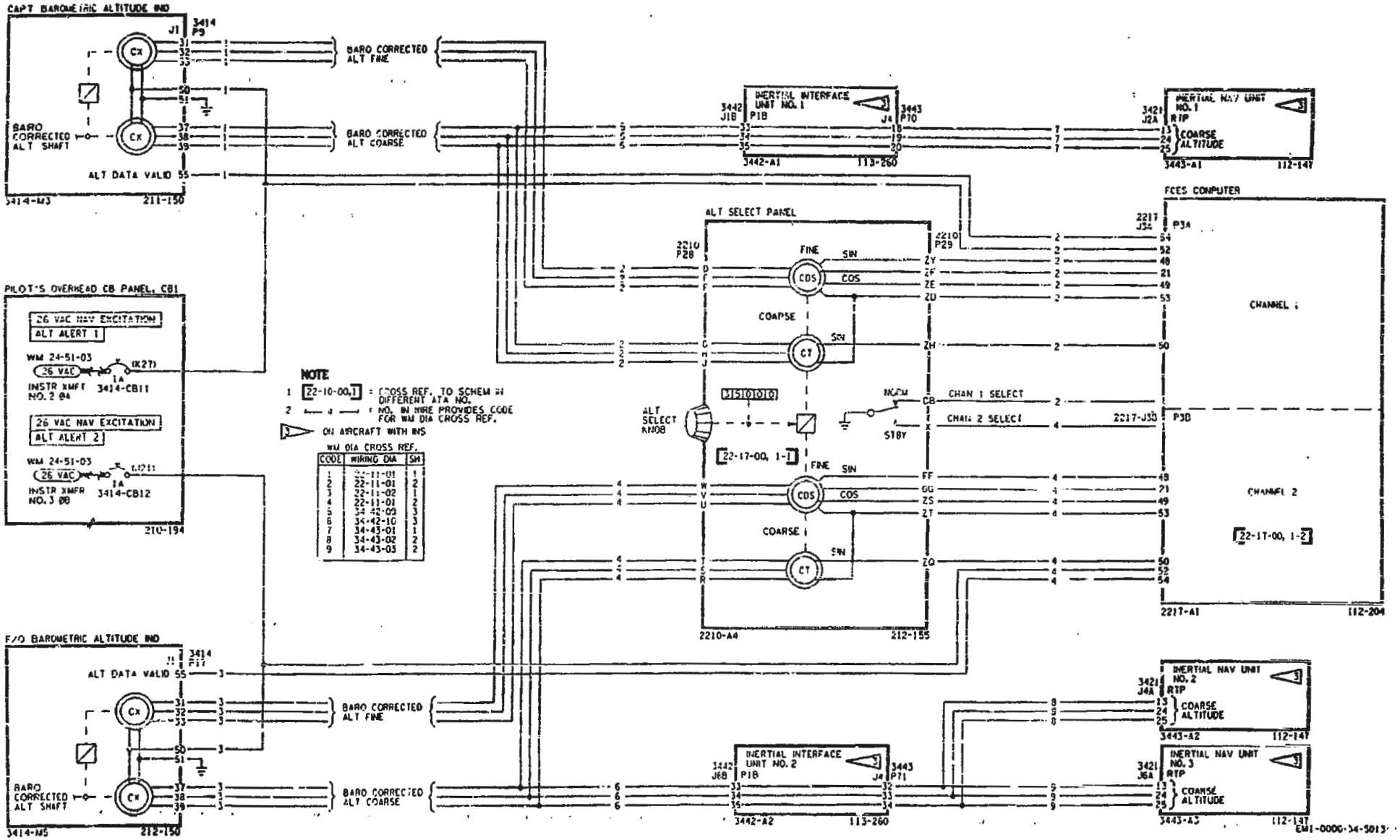
001B



R Air Data Computer No. 2 Interface Schematic
R SCHEM 3 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

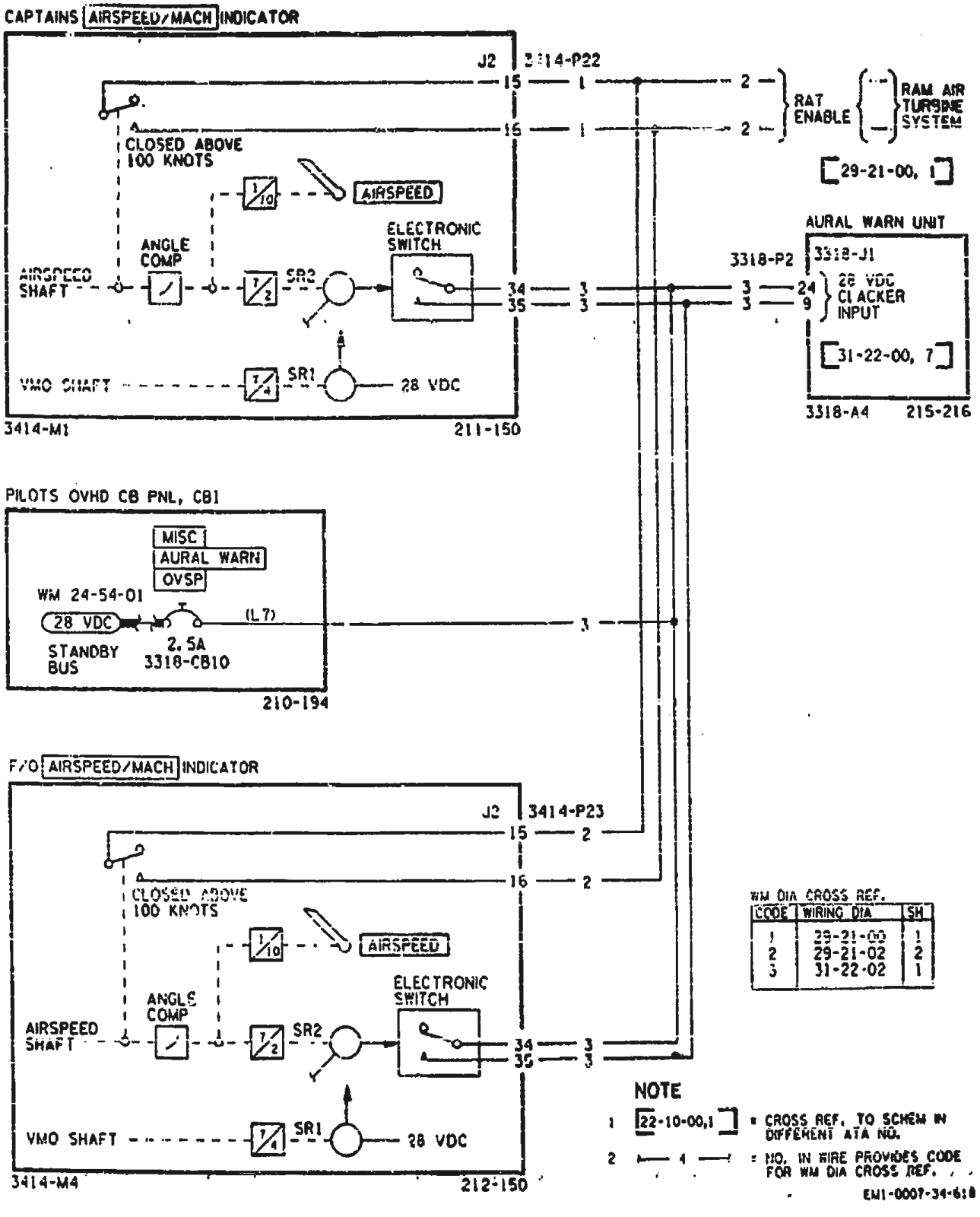
001B



R Altitude Indicator and Altitude Select Panel Interface Schematic
R SCHEM 4

EFFECTIVITY: ALL

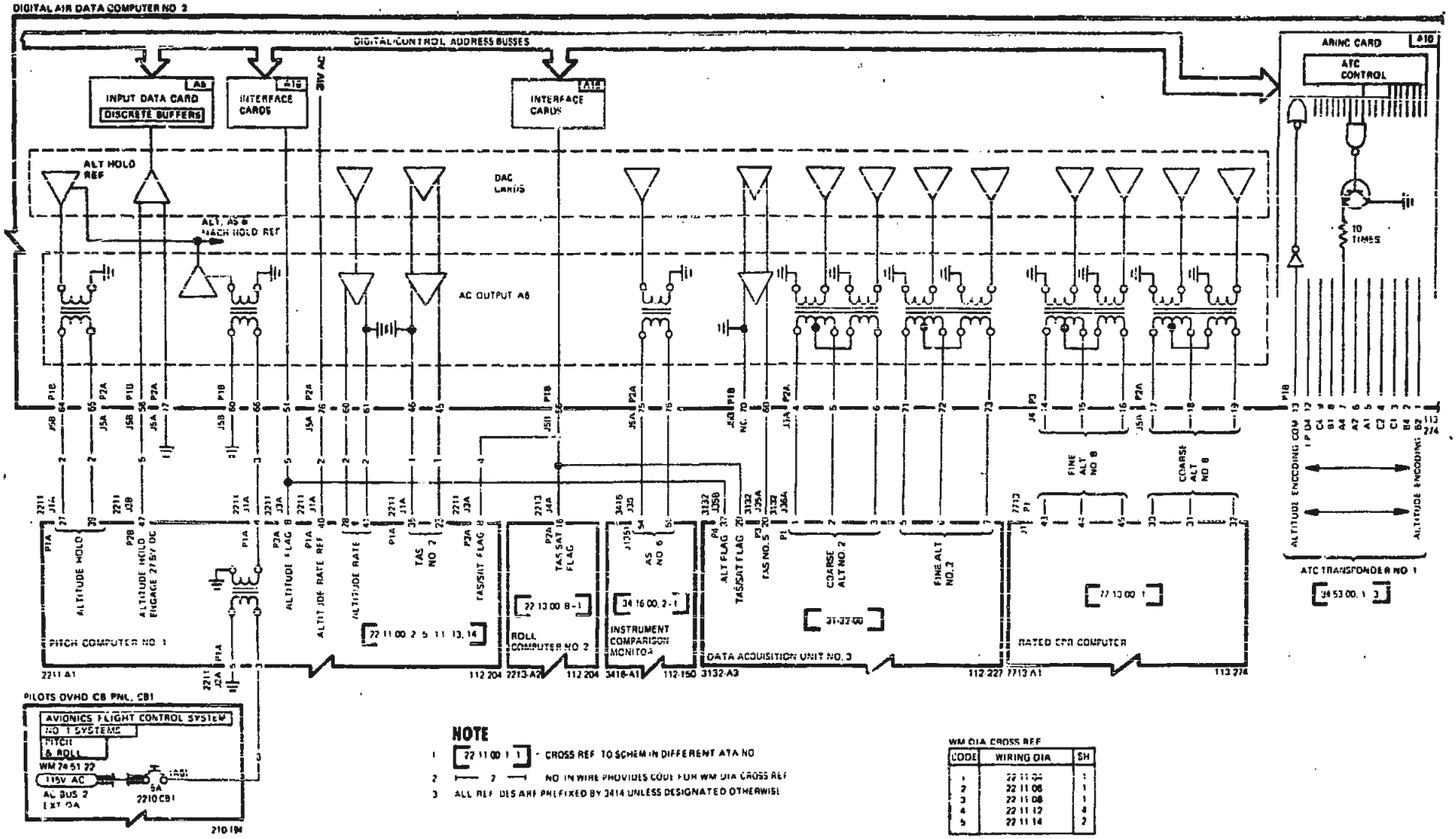
0018



R Airspeed Indicator Interface Schematic
R SCHEM 5

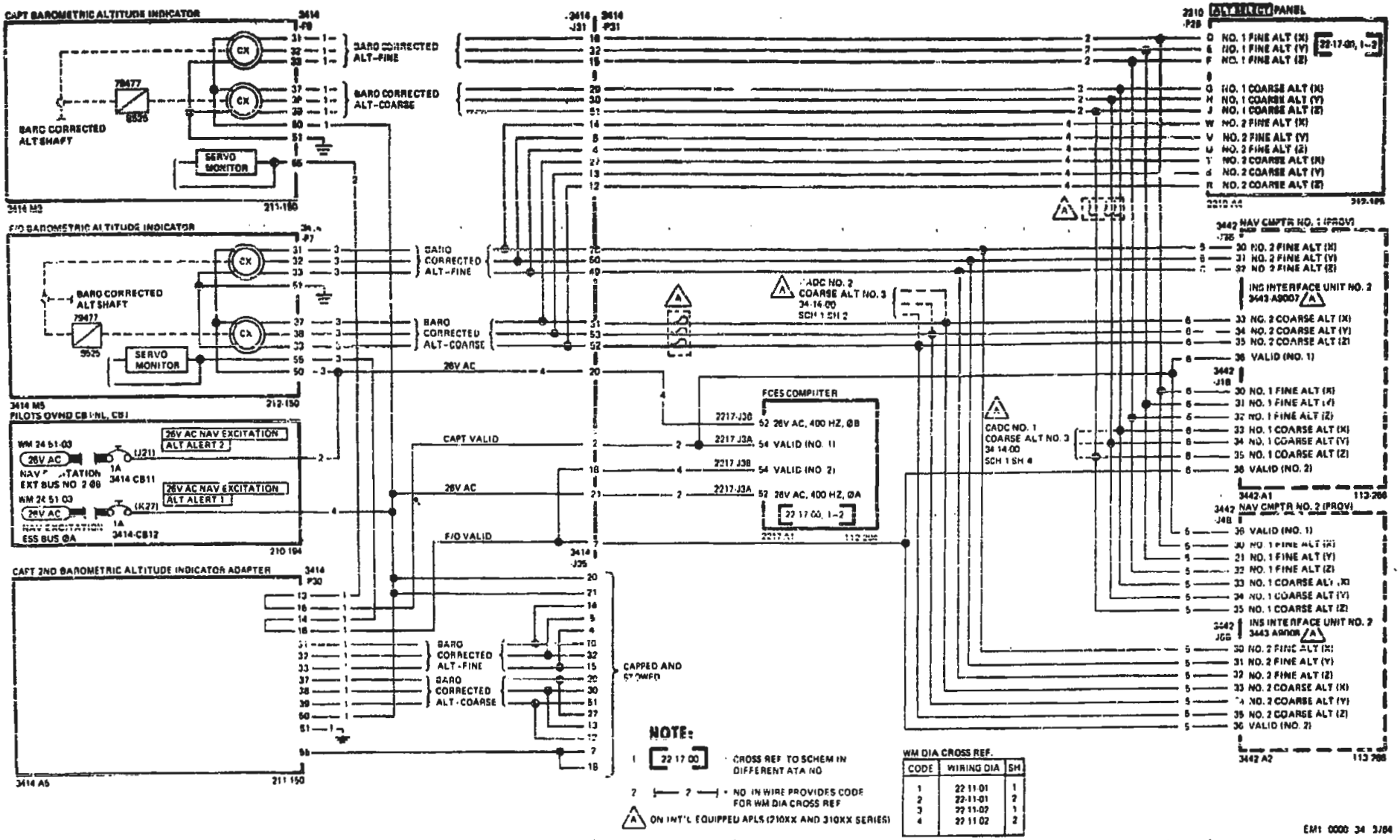
EFFECTIVITY: ALL

001B



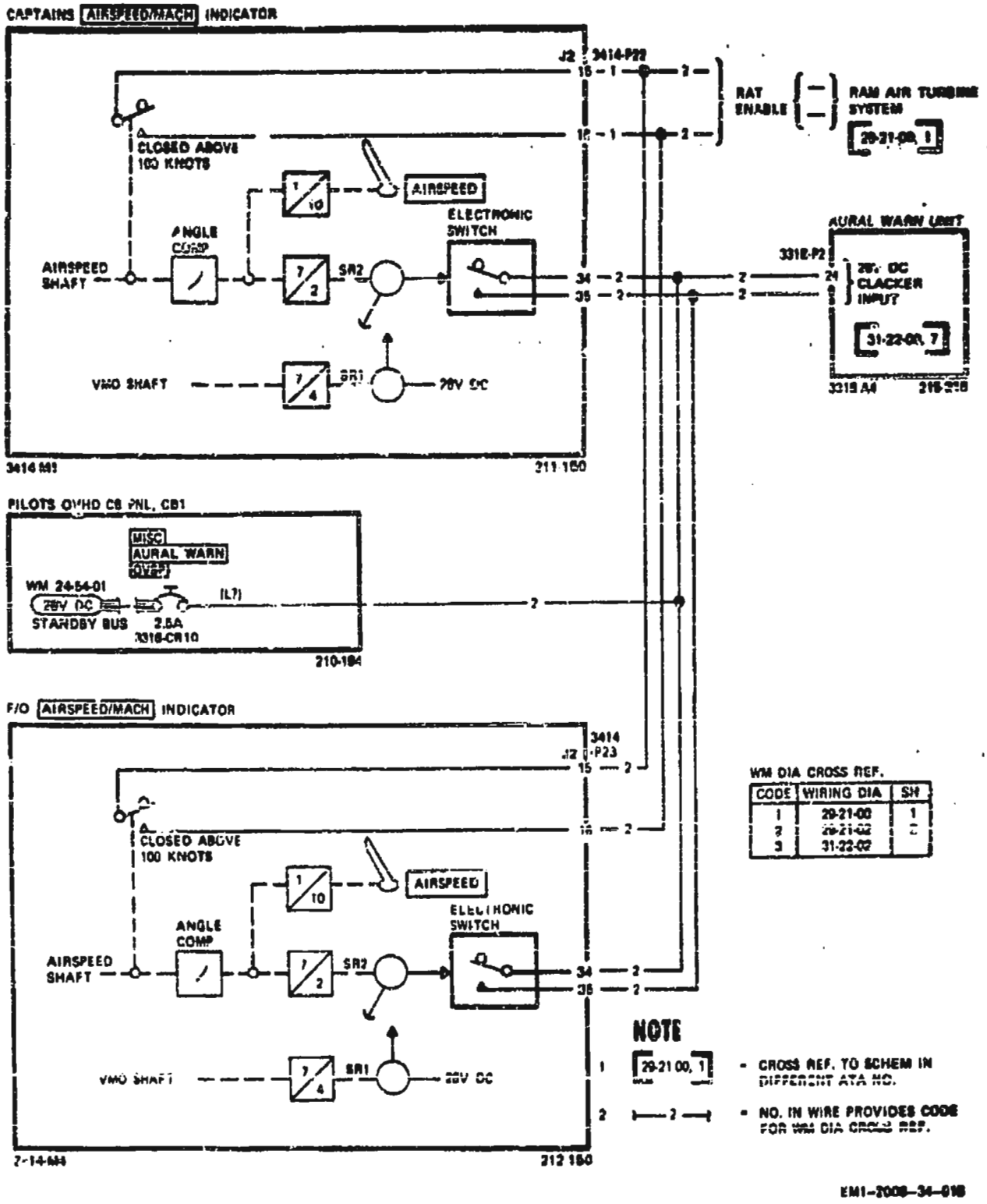
ADC System Interface Schematic
SCHEM 2 (Sheet 4)

R
R
001B EFFECTIVITY: A/C WITH DIGITAL ADC



C
C ADC System Interface Schematic
SCHEM 2 (Sheet 5)

R
R EFFECTIVITY: A/C WITH DIGITAL ADC
001B



C
C

System Interface Schematic
SCHEM 2 (Sheet 6)

R
R
001B

EFFECTIVITY: A/C WITH DIGITAL ADC

CR

AIR DATA INSTRUMENT - MAINTENANCE PRACTICES

CR 1. Maintenance Notes, Tolerances, and Regulations

CR A. General

CR The instrument tolerance listed in this section are in service
CR type, and where possible are given as the spread or difference
CR between the Captains and F/O instruments.

CR B. Instrument Tolerances

CR (1) Altimeters

CR (a) Servo Altimeters

CR 1) At field elevation the servo altimeter
CR should read within +0 -40 feet of actual
CR field elevation with correct altimeter
CR setting applied.

CR NOTE: Above tolerance is for altimeter pointer as
CR an additional ±20 feet should be permitted
CR on counter.

CR 2) Spread tolerance servo altimeters

CR

Altitude (X1000)	Difference between altimeter readings
0 - 8 ft	40 ft
8 - 10 ft	50 ft
10 - 15 ft	60 ft
15 - 20 ft	80 ft
20 - 25 ft	100 ft
25 - 30 ft	120 ft
30 - 35 ft	140 ft
35 - 40 ft	160 ft
40 - 45 ft	180 ft

CR (b) Standby altimeter

CR 1) At field elevation the standby altimeter
CR should read +70 - 30 feet of actual
CR field elevation with correct altimeter
CR setting applied.

CR 2) Spread tolerance between standby and servo
CR altimeters.

Altitude	Difference between altimeters
0	40
5	70
10	110
20	180
25	210
30	240
35	280
40	280

(2) Indicated Airspeed

(a) Servo Mach/Airspeed Indicators

Airspeed	Difference between indicators
60	5
100	3
120	3
150	3
180	4
220	5
250	5
300	6
350	6
400	7

(b) Standby Airspeed Indicator

Airspeed	Difference between indicators
60	7
100	5
120	5
150	5
180	6
220	7
250	7
300	8
350	8
400	9

(3) Machmeter

Mach number	Difference between indicators
0.300	0.010
0.500	0.010
0.600	0.010
0.700	0.010
0.750	0.013
0.800	0.015
0.820	0.015
0.850	0.015
0.870	0.018
0.900	0.020

(4) Maximum operating airspeed pointer tolerance is ±6 knots with a maximum difference between indicators of 10 knots.

(5) The vertical speed indicator tolerance at zero is ±50 feet with a maximum difference between indicators of 75 feet.

Rate	Difference between indicators
500 feet per minute	90 feet
1000 feet per minute	120 feet
2000 feet per minute	200 feet
3000 feet per minute	270 feet
4000 feet per minute	350 feet
5000 feet per minute	420 feet

(6) Static air temperature tolerance is ±1.5°C

NOTE: If computing use F/O instruments.

(7) True airspeed indicator tolerance is ±5 knots.

NOTE: If computing use F/O instruments.

(8) Field Elevation Chart

A field elevation chart, listing ramp elevation in feet is provided in Figure 201 to allow setting field elevation into the altimeters and checking the tolerance.

STATIONS FIELD ELEVATION IN FEET

STA	GATE	MNT. RAMP	CARGO RAMP	STA	GATE	MNT. RAMP	CARGO RAMP
ABQ	5315			DAY	1005		
AGP	39			DCA	15		
AHA	14			DEN	5293		
AMA	3592			DTW		656	
ATH	87		88	DUB	220		
ATL	988			EWR	9		
BAL	153		161	FCO	2		23
BDL	171		173	FRA	363		368
BKK	13			GUM	264		
BNA	*			GVA	1381		
BOM	16			HAR	320		
BOS	13		20	HKG	15		
CAI	236		225	HNL	13		
CDG	351		306	IAD	299		
CLE	785			ICT	1020		
CMH	814			IND	793		788
CVG	869			JFK	16	16	15

*BNA Gates 1, 2 and 4 561
Gates 3, 5, 7, 9, 11, and 15 568
Gates 6, 8, 10, 12, and 14 558

M1-0000-34-3861

CR
CR

Field Elevation Chart
Figure 201 (Sheet 1)

R EFFECTIVITY: ALL
R
002B

STA	GATE	MNT. RAMP	CARGO RAMP	STA	GATE	MNT. RAMP	CARGO RAMP
LAS	2100			ORY	276		283
LAX	118	115	85	PHL	14		3
LGA	10			PHX	1113		
LHR	75		60	PIT	1150		[illegible]
LIS	320			SDF	474		
MAD	1993		2000	SFO	6	**10	4
MCI	1003	1021	982	SNN	4		
MDT	320			STL	552		557
MDW	602			TLV	127		131
MIA	10			TPA	20		
MKC	740		742	TPE	21		
MXP	761		759	TUL	651		
OAK	10			TUS	2602		
OKC	1291			ZRH	1400		1405
ORD	653		650				

**SFO Maint Ramp 10' both new and old hangar.

M1-0000-34-3862

CR
CR

Field Elevation Chart
Figure 201 (Sheet 2)

R EFFECTIVITY: ALL
R
002B

ANALOG/DIGITAL AIR DATA COMPUTER SYSTEM - ADJUSTMENT AND TEST

1. General

NOTE: This procedure applies to a digital or analog air data computer (ADC) either in a mixed or non-mixed configuration. The only difference is the SELF TEST (BITE), Steps 4C and 4D.

R Analog and digital ADCs may be mixed and are
R interchangeable. wiring or outputs are not affected, the
R only difference is in cooling air input connections to the ADCs.

The air data computer (ADC) system consists of two identical ADC systems, No. 1 and No. 2, which supply data to Captains and First Officers instruments. INSTRUMENT SOURCE SELECT panels allow either ADC to be used with either set of instruments. Adjustment of the ADC system is not required. Testing of the ADC system can be accomplished by performing a (BITE) TEST, Step 4E.

For a more complete functional test, ensure autopilot system is disengaged; both A and B bathandles on APFD engage panel set to OFF. If electrical power is ON and either or both bathandles are UP, press autopilot disconnect switch on either control wheel.

2. Equipment and Materials

Equipment and materials required to perform leak and functional tests are listed below:

Type MB-1 Pitot/Static field tester, Burton 2024B Pitot/Static tester or equivalent (2 required). Refer to Chapter 34 of Illustrated Tool and Equipment Manual for Description and Operation. Proximity Sensor Artificial Target (Ref. 20-31-01).

RAT Ground Safety Lock - P/N 1304565.

3. Referenced Procedures

24-00-00	Electrical Power - Maintenance Practices
32-63-00	Air/Ground Sensing - Maintenance Practices
34-00-01	Instrument Source Selector Panel - Adjustment and Test

34-13-00 Pitot-Static System Leak Test - Adjustment and Test

34-16-00 Central Instrument Warning System - Adjustment and Test

4. Adjustment/Test

A. Preparation

(1) Turn electrical power ON (Ref. 24-00-00).

(2) Verify AVIONIC AIR - FWD and MID LO FLO lights on FE/SO ECS MONITOR panel are OUT.

(3) On MASTER RADIO panel, pilots overhead panel, verify ESSENTIAL and NO. 2 switchlights are latched in, OFF lights not lighted.

(4) Verify pitot-static probes and total air temperature sensors are not damaged or plugged with foreign material.

WARNING: INSTALL "RAT" GROUND SAFETY LOCK (Ref. 32-63-00).

(5) On pilots overhead circuit breakers panel CB1, open and tag the following circuit breaker:

RAT - MAN - DEPLOY (B14)

RAT - AUTO - DEPLOY (L3)

LANDING GEAR - WARN - HORN (L12)

WARNING: DOUBLE CHECK THAT "RAT" GROUND SAFETY LOCK IS INSTALLED AND RAT AUTO DEPLOY CIRCUIT BREAKER (1L3) IS OPEN AND TAGGED.

(6) On FE/SO overhead circuit breaker panel CB2, open and tag the following circuit breakers:

ANTI-ICE - PITOT HEAT - F/O - SEC (E16)

ANTI-ICE - PITOT HEAT - F/O - RPIM (E17)

ANTI-ICE - PITOT HEAT - CATP - SEC (E18)

FLAP LOAD - RELIEF - CHAN 1 (H12)

FLAP LOAD - RELIEF - CHAN 2 (H20)

(7) Verify pitot static systems are open to atmosphere.

(8) On pilots overhead circuit breaker panel CB1, zone 210, verify following circuit breakers are closed:

INSTR - CMPRN - MON PWR (D8)

INSTR - CMPRN - MON (D26)

ALT SOURCE SEL - CAPT - INSTR (E1)

ALT SOURCE SEL - F/O - INSTR (E2)

VERT - SP IND (E4)

VERT - SP IND (E21)

CAPT - IAS/ - MACH (F1)

CAPT - ALTM (F4)

F/O - IAS/ - MACH (F19)

F/O - ALTM (F22)

SAT/ - TAS (F27)

AIR - DATA - CMPTR (G8)

AIR - DATA - CMPTR (G27)

PROX - SW PWR - NO. 1 (L10)

PROX - SW PWR - NO. 4 (L11)

(9) On FE/SO aft circuit breaker panel CB3, open and tag the following circuit breaker:

CAPT - PRI PITOT - HEAT (H14)

(10) On FE/SO aft circuit breaker panel CB3, verify the following circuit breakers are closed:

ESS RADIO BUS - DC (F6)

ESS RADIO BUS - AO (F7)

ESS RADIO BUS - BO (F8)

ESS RADIO BUS - CO (F9)

TAT/ - EPR (R12)

NO. 2 RADIO BUS - MASTER CONT (AA12)

NO. 2 RADIO BUS - DC (AA13)

NO. 2 RADIO BUS - AO (AA14)

NO. 2 RADIO BUS - BO (AA15)

NO. 2 RADIO BUS - CO (AA16)

NOTE: Prior to removal of any equipment which fails to meet requirements of this test procedure, electrical power to AIR DATA COMPUTERS No. 1 and No. 2 must be turned OFF at circuit breakers and circuit breakers must be tagged to prevent their reclosure without cognizance of responsible test personnel.

(11) On both INSTRUMENT SOURCE SELECT panels (Ref. 34-00-01), press switchlights as follows:

(a) ALTN AS/M switch to normal (not lighted).

(b) ALTN ALT switch to normal (not lighted).

CAUTION: ENSURE TEMPERATURE PROBE NO. 2 HEATER HAS BEEN OFF FOR AT LEAST 15-MINUTES.

NOTE: Allow 10-minute warmup.

R (12) On aircraft without SB34-054,
R to prepare for SAT/TAS/TAT portion of test, place
R accurate thermometer adjacent to Total Air Temperature
R probe located on right side of forward fuselage.
R Shield from direct sunlight and allow to stabilize
R before recording temperature reading. Two technicians
R may be required to perform SELF TEST. One technician
R initiates SELF TEST on ADC No. 1 (No. 2), the other
R observes flight station instruments.

R (12) On aircraft with SB34-054,
R to prepare for SAT/TAS/TAT portion of test, place
R accurate thermometer adjacent to Total Air Temperature
R probe located on left side of forward fuselage. Shield
R from direct sunlight and allow to stabilize before
R recording temperature reading. Two technicians may be
R required to perform SELF TEST. One technician
R initiates SELF TEST on ADC No. 1 (No. 2), the other
R observes flight station instruments.

(13) On pilots instrument panel, verify warning flags on following instruments are NOT in view:

Capt (F/O) Barometric Altitude Indicator

Capt (F/O) Airspeed/Mach Indicator

Capt (F/O) Vertical Speed Indicator

(F/O) SAT and TAS indicators

Total Air Temperature Indicator

(14) Verify knobs on Altimeters and Airspeed indicators may be adjusted with slight friction but without stiction.

(15) Set Altimeters to 29.92-IN HG (1013-MB).

(16) Verify Altimeter readings are within 40-feet of each other, note altitude readings.

NOTE: Slight tapping is required to reduce friction affects in pneumatic standby airspeed indicator.

(17) Set Altimeters to 29.39-IN HG (995-MB).

(18) Verify altitude reading noted in Step 4A(16), is -500 ± 30 feet.

(19) Set Altimeters to 30.47-IN HG (1032-MB).

(20) Verify altitude reading noted in Step 4A(16) is +500 ± 30 feet.

(21) Return Altimeters to 29.92-IN HG (1013-MB).

(22) On pilots instrument panels verify INSTR COMPARATOR panels do NOT show messages (Ref. 34-16-00).

(23) Verify following indicator readings:

Airspeed/Mach Indicator:

Airspeed pointer - 57 to 65-knots.

Vmo pointer - 350 to 365-knots.

NOTE: Vmo pointer reading depends upon altitude at which test is made. Reading increases approximately 2.25-knots per 1000-feet of altitude. Tolerance is ±5-knots to 20,000-feet and ±6-knots above 20,000-feet. If Vmo pointer indicates 270-knots, pointer is set to low speed position. Open selectable Vmo access panel and reset to 375 position.

MACH - 0.120 to 0.220.

Capt (F/O) Vertical Speed Indicator shows DOWN 50 to UP 50-feet per minute. (F/O) Static Air Temperature (SAT) Indicator shows outside air temperature ±5°C.

(F/O) True Airspeed (TAS) Indicator shows 100 to 140-knots.

Total Air Temperature indicator OFF flag out of view and indicates outside air temperature ±5°C.

B. Instrument Switching Check

(1) Turn Master Radio switches to ON.

(2) Verify ALTN AS/M and ALT switchlights on Capt (F/O) Instrument Source Select Panels are set to normal (not lighted) (Ref. 34-00-01).

(3) Press ALTN AS/M and ALT switchlights on Capt Instrument Source Select Panel to alternate (lighted).

(a) Verify Capt Baro Altitude Indicator tracks F/O Baro Altitude Indicator ± 20-feet.

(b) Verify Capt VSI tracks F/O VSI ±50-FPM.

(c) Verify annunciators on Capt (F/O) Instrument Failure Warning Displays do NOT show ALTITUDE or AIRSPEED messages.

(4) Press ALTN AS/M and ALT switchlights on Capt Instrument Source Select Panel to normal (not lighted).

(5) Press ALTN AS/M and ALT switchlights on F/O Instrument Source Select Panel to alternate (lighted).

(a) Verify F/O Baro Altitude Indicator tracks Capt Baro Altitude Indicator ± 20-feet.

(b) Verify F/O VSI tracks Capt VSI ± 50-FPM.

(c) Verify annunciators on Capt F/O Instrument Failure Warning Displays do NOT show ALTITUDE or AIRSPEED messages.

(6) Press ALT AS/M and ALT switchlights on F/O Instrument Source Select Panel to normal (not lighted).

C. ANALOG ADC SELF TEST

NOTE: On aircraft with a mixed (analog/digital) configuration, it is recommended that each system be tested individually.

Two analog, or two digital systems may be tested at the same time.

(1) On ADC No. 1 (No. 2), press and hold SELF TEST pushbutton through completion of Step 4C. ADC will slew to a predetermined set of indications. During this time, observe following indications on Capt (F/O) instruments.

NOTE: The term slew as used throughout test means to drive, or turn instrument indications.

(a) Airspeed/Mach Indicator

AS, MACH, and Vmo flags in view.

Airspeed, Vmo pointers and MACH counter changing.

(b) Barometric Altitude Indicator

SSC and OFF flags in view.

Altitude counter and pointer move up.

(c) Vertical Speed Indicator

OFF flag in view.

Pointer indicates in excess of 6000-feet per minute CLIMB.

(d) SAT and TAS indicators (ADC No. 2 only)

OFF flags in view.

(2) On ADC No. 1 (No. 2) and Capt (F/O) instruments, when servos stop slewing with SELF TEST pushbutton still pressed, verify following:

(a) Airspeed/Mach Indicator

AS, MACH, and Vmo flags out of view.

Airspeed pointer indicates between 241 and 251-knots.

Vmo pointer indicates between 240 and 252-knots.

MACH counter indicates between .885 and .915.

(b) Barometric Altitude Indicator

SSC and OFF flags out of view.

Altitude counter indicates between 44,880 and 45,120-feet.

C Pointer indicates 880 to 120-feet, but must be within ±20 feet of counter reading.

(c) Vertical Speed Indicator

OFF flag out of view.

Pointer indicates 0 ±50-feet per minute.

C (d) SAT and TAS indicators (ADC No. 2 only). USING
C TAT indicator reading, verify SAT and TAS readings
C in self test column of Table 502.

(3) On ADC No. 1 (No. 2), release SELF TEST pushbutton. Servos start slewing. Observe following indications on Capt (F/O) instruments while servos are slewing to rest, or initial position:

(a) Airspeed/Mach Indicator

AS, MACH, and Vmo flags in view.

Airspeed, Vmo pointers and MACH counter are changing.

(b) Barometric Altitude Indicator

SSC and OFF flags in view.

Altitude counter and pointer move down.

(c) Vertical Speed Indicator

OFF flag in view.

Pointer indicates in excess of 6000-feet per minute DOWN.

(d) SAT and TAS indicators (ADC No. 2 only).

OFF flags in view.

(4) If no further tests are to be performed, go to test completion Step 4F.

D. DIGITAL ADC (BITE) TEST

NOTE: The BITE System consists of two modes, SELF TEST and SLEW TEST. Pressing the TEST Switch initiates SELF Test which turns on the TEST-IN-PROGRESS light. While the TEST-IN-PROGRESS light is on, pressing the TEST Switch a second time initiates SLEW Test.

The (BITE) in the following Steps applies to ADC No. 1 or No. 2.

(1) Perform preparation, Step 4A.

NOTE: It is desirable to test two systems at the same time.

(2) On ADC, depress and hold test switch for at least one second, but less than 10 seconds and release.

(a) FAULT light comes ON while switch is depressed.

(b) Flags on data instrument will be in view.

(c) ADC TEST IN PROGRESS light will be ON.

(d) Ten seconds after test switch is released; TEST IN PROGRESS light will flash, FAULT light will be OFF and air data instrument fail flags will be out of view.

(e) TEST IN PROGRESS light will flash for approximately 15 seconds and then go OFF. While light is flashing, check air data instruments for the following indications:

- Altitude 1000 ± 10-ft
- Vertical Speed 6000 ±200-FPM (Dive)
- Airspeed 60 ±6-knots
- Ignore Mach reading

NOTE: Initiate the following step before TEST IN PROGRESS light goes out or ADC will revert to normal operation.

(f) Again depress ADC test switch for at least one second, but not more than 10-seconds, and release.

When TEST IN PROGRESS light is flashing, press TEST button again for one second, but not more than 10 seconds, and release.

(g) TEST IN PROGRESS light must come on steady.

(h) Verify air data instruments are slewing and no flags are in view. During a two minute slew period, altitude and vertical speed will stop and hold for approximately 1/2 minute at 9600 feet altitude and 0 FPM vertical speed.

(i) After approximately two minutes, the air data instruments must read as follows:

Altitude 27,300 ± 100 feet

Vertical Speed 3,500 ± 100 FPM (Climb)

Airspeed 280 ± 6 knots

Mach 0.86 ± 0.01

(j) Verify that clacker sounds for approximately 7 seconds when overspeed is above BARBER POLE.

(k) After approximately 2.5 minutes, air data instruments will again slew. Slew will be completed in approximately 4.5 minutes.

(l) The test concludes with ADC returning to normal operation, instruments rapidly returning to pretest states and the TEST IN PROGRESS light will be out.

NOTE: Figure 501, Sheet 1 describes the ADC Test in pictorial form; Figure 501, Sheet 2 identifies test outputs to flight instruments.

(3) If only one system was tested, repeat Step 4D(1) thru 4D(2)(l) for opposite system.

(4) If ADC-2 is being tested, check TAS/SAT indicators on F/O instrument panel during Step 4D(2)(e), while TEST IN PROGRESS light is on steady, indications will be as follows:

- TAS and SAT fail flags will be in view
- TAS will indicate 200 ±5 knots

- SAT will indicate 50° ±5°

(5) If no further tests are to be performed, go to test completion, Step 4F.

E. Functional Test

CAUTION: DO NOT EXCEED 4000-FPM CLIMB/DESCENT AT ANY TIME DURING THIS TEST.

(1) Perform preparation, Step 4A.

(2) Pitot-Static Leak Check

(a) Perform pitot-static leak test (Ref. 34-13-00, page 501) using two pitot-static testers, one for Capt, one for F/O pitot-static systems. Do not disconnect testers or turn power OFF after finishing pitot-static leak test.

NOTE: If only altitude checks are to be performed, Capt and F/O pitot-static lines may be tied in parallel to one tester.

Allowances in altitude must be made for differences in elevation from test equipment to pressure sensors in airplane. If tester is located 20-feet below ADC, servoed altimeters will read 20-feet higher than test equipment altimeter.

In order to minimize hysteresis effects, reversal in static pressure changes must be avoided. Test points should be approached gradually and without overshooting.

INSTR COMPARATOR panel messages will come ON during functional test steps.

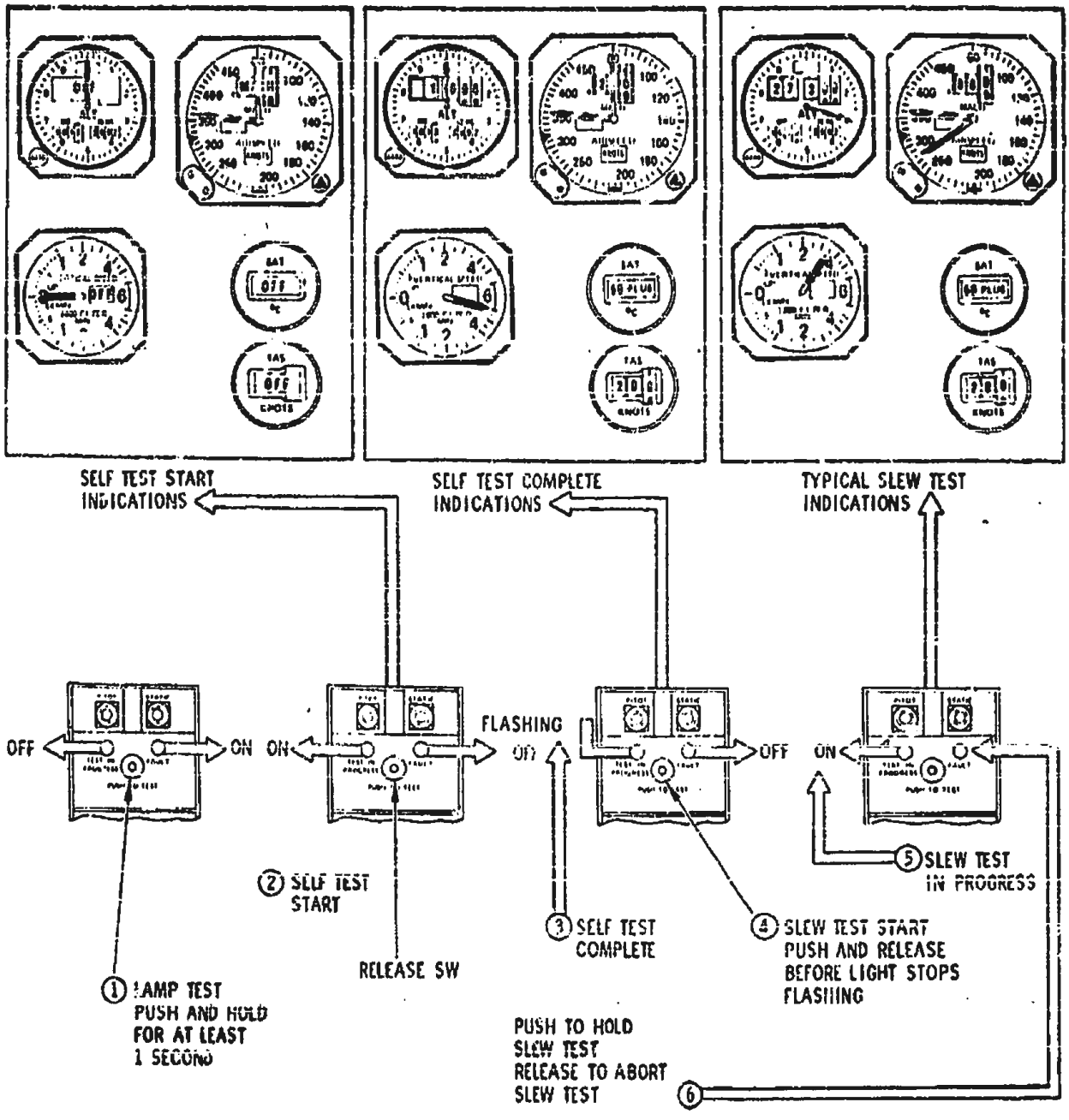
(3) Initial Ground Check

(a) Verify Capt and F/O Barometric Altitude, Airspeed/Mach, and Vertical Speed Indicators internal lighting is ON.

(b) On both testers perform the following:

Prepare for altitude and airspeed.

Set altitude, airspeed, and rate-of-climb to first values listed in Table 501. Turn testers ON.



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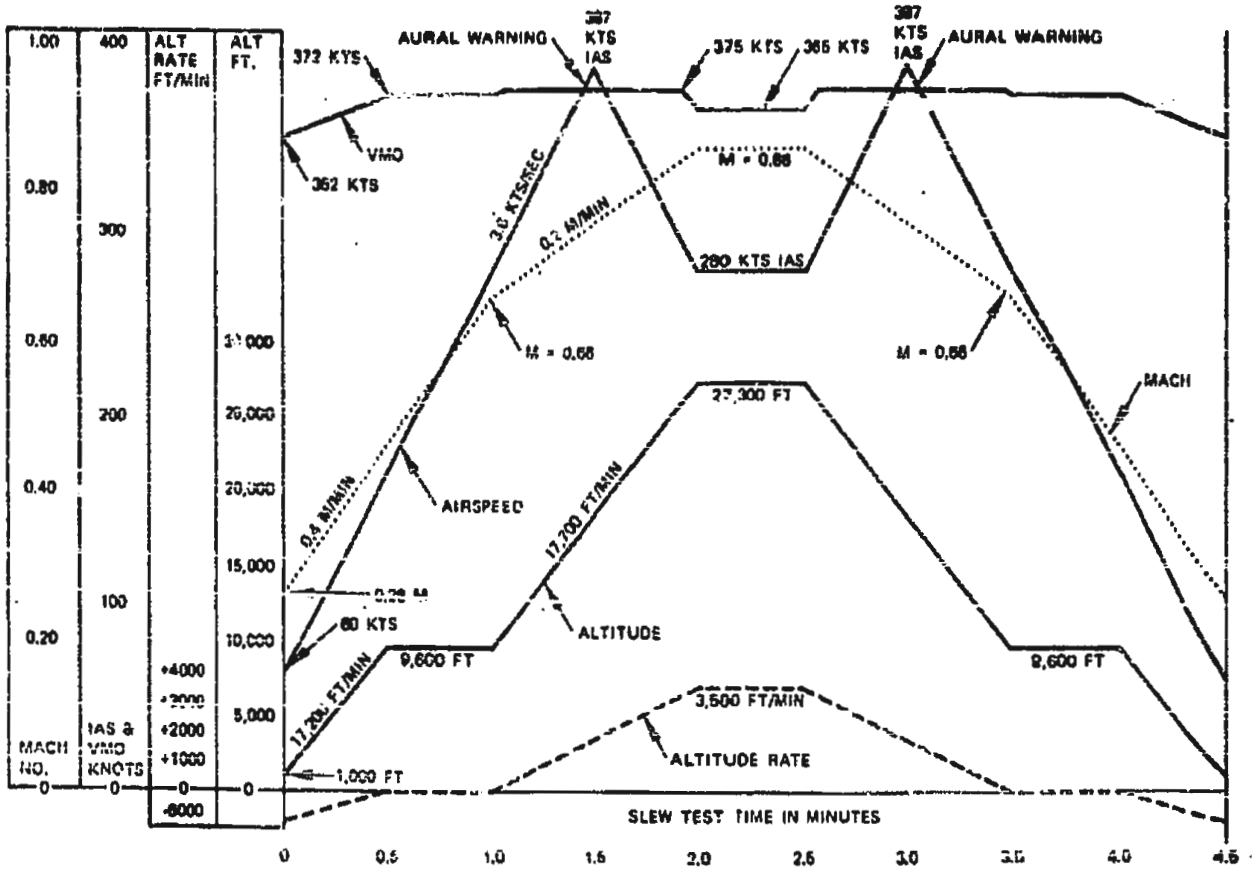
Digital ADC Testing
Figure 501 (Sheet 1)



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Digital ADC Testing
Figure 501 (Sheet 2)

(c) On both testers perform following:

Start altitude climb.

Verify first values listed in Table 501 when altitude and airspeed are attained.

(d) Verify INSTR COMPARATOR panels are not displaying messages.

(4) Set both testers successively to values listed in Table 501. Verify instrument readings. Perform checks listed in Table 501 at altitude levels shown.

Air Data System Accuracy Checks
Table 501

	ALT FT	AS KNOTS	R/C FT/MIN	INSTRUMENT READINGS AND TOLERANCES			
			4000 (MAX)	ALT FT	A/S KNOTS	MACH	Vmo KNOTS
C	FIELD LEVEL	60		+60, -40	57-65	.120-.220	350-365 (sea level)
	3,000	160	4,000 Climb	2,950-3,050	155-165	.235-.275	352-363
	Perform landing gear warning check (ADC No. 1 only), Step 4E(5)						
	5,000	240	4,000 Climb	4,940-5,060	235-245	.376-.416	357.5-367.5
	Perform overspeed warning check, Step 4E(6)						
R	5,000-16,000		2,000 Climb	VSI - 1700-2300 FPM CLIMB			
	16,000	200	4,000 Climb	15,930-16,070	195-205	.387-.427	370-380
	Perform SAT/TAS check, Step 4E(7)						
	20,000	370	4,000 Climb	19,920-20,080	364-376	.779-.809	370-380
	30,000	300	4,000 Climb	29,920-30,080	294-306	.776-.806	340-352
	Perform SAT/TAS check, Step 4E(7)						
	Perform instrument comparison check, Step 4E(8)						
	40,000	278	4,000 Climb	40,020-40,250	273-284	.895-.925	270-282
	10,000		800 Down	VSI - 600-1000 FPM DOWN			

(5) Landing Gear Warning Horn Check (3,000-feet altitude)

NOTE: Only Capt pitot-static tester is required for this test.

(a) On pilots overhead CB panel CB1 close following circuit breakers:

LANDING GEAR - WARN - HORN (L12)

AURAL WARN MULT - SND (L8)

(b) On FE/SO overhead CB panel CB2, verify T/O - AURAL - WRN (H7) circuit breaker is closed.

(c) On Capt tester rotate AIRSPEED REGULATOR to 240-knots.

R R R R (d) Simulate main landing gear not down and locked condition at left or right main gear by inserting an aluminum artificial target (Ref. 20-31-01) between the gear down lock sensor and its target.

(e) At pilots center console retard all three engine power control levers to idle position.

(f) Verify flap handle is set to full up or zero position.

(g) On Capt tester, decrease airspeed until landing gear warning horn sounds.

(h) Verify tester airspeed indicator reads 173 to 187-knots.

NOTE: Landing gear warning horn should have commenced to sound at 180 ±7-knots, normally it should be very close to 180-knots as 180 is approached with decreasing airspeed.

(i) Increase airspeed until landing gear warning horn is silenced, airspeed indicator should be between 173 to 187-knots.

NOTE: Landing gear warning horn should have been silenced at 180 ±7-knots, normally it should silence very close to 180-knots as 180 is approached with increasing airspeed.

(j) Remove artificial target from main landing gear air-ground sensor (Ref. 20-31-01).

(k) Open circuit breaker closed in Steps Steps 4E(5)(a) and 4E(5)(b).

(6) Overspeed Warning Check (6,000-feet altitude)

NOTE: Two pitot-static testers are required for this test.

Test should be performed at both 270-knot and 375-knot position of selectable VMO pointer switch on each airspeed/Mach indicator. Readings in 270-knot position are shown in parenthesis.

(a) On CB1, close AURAL WARN - OVSP (L7) circuit breaker. On CB2, close T/O - AURAL - WRN (H7) circuit breaker.

CAUTION: THE AURAL WARNING DEVICE (CLACKER) MUST NOT BE ENERGIZED FOR MORE THAN 5-MINUTES OR DAMAGE MAY RESULT DUE TO OVERHEATING. AT LEAST 15-MINUTES MUST BE ALLOWED BETWEEN TESTS IF TOTAL DURATION OF TEST REACHES 5-MINUTES. (b) Set airspeed on Capt tester to 360 (255)-knots without overshoot. Verify clacker is OFF.

(c) On Capt tester slowly increase airspeed until clacker comes ON.

NOTE: The difference between airspeed pointer and Vmo pointer must not exceed ±3-knots when clacker is activated. (d) Verify airspeed of 373 (268)-knots or less on tester.

(e) On Capt tester slowly decrease airspeed until clacker goes OFF. (4) Verify 360 (255)-knots or more on tester.

(g) Repeat Steps 4E(7)(b) through 4E(7)(f) using F/O tester.

(h) On CB1, open AURAL WARN - OVSP (L7) circuit breaker. On CB2, open T/O - AURAL - WRN (H7) circuit breaker.

(7) SAT/TAS check (16,000-ft and 30,000-ft altitudes)

(a) Read TAT on TAT/RATED EPR Indicator.

(b) Using MACH and TAT readings refer to Table 502 to determine SAT and TAS indicator readings.

(8) Instrument Comparator Check (30,000-ft altitude)

(a) On F/O tester slowly increase altitude until both INSTR COMPARATOR annunciators display ALTITUDE message.

(b) Verify F/O Barometric Altitude Indicator reads 160 to 240-feet more than Capt indicator.

(c) On Capt tester increase altitude until INSTR COMPARATOR annunciators go OFF and display ALTITUDE message.

(d) Verify Capt Barometric Altitude Indicator reads 160 to 240-feet more than F/O indicator.

(e) On F/O tester, increase airspeed until INSTR COMPARATOR annunciators display AIRSPEED message.

(f) Verify AIRSPEED on F/O Airspeed/Mach Indicator reads 4 to 11-knots more than Capt indicator.

(g) On Capt tester, increase airspeed until INSTR COMPARATOR annunciators go OFF and display AIRSPEED message.

(h) Verify AIRSPEED on Capt Airspeed/Mach Indicator reads 4 to 11-knots more than F/O indicator.

(9) Instrument Source Select Check

NOTE: Two pitot-static testers are required for this test.

(a) On Capt INSTRUMENT SOURCE SELECT panel, press ALTN AS/M and ALT switchlights to alternate (ALTN lights).

(b) Verify Capt Barometric Altitude and Airspeed/Mach Indicators track F/O indicators within following tolerances:

Barometric Altitude Indicators

ALT - ±20-ft.

Airspeed/Mach Indicators

AIRSPEED - ±5-knots.

Vmo - ±6-knots.

MACH - ±0.010-Mach.

(c) On Capt INSTRUMENT SOURCE SELECT panel, press ALTN AS/M and ALT switchlights to normal (not lighted).

(d) On F/O INSTRUMENT SOURCE SELECT panel, press ALTN AS/M and ALT switchlights to alternate (ALTN lighted).

(e) Verify F/O Barometric Altitude and Airspeed/Mach Indicators track Captains indicators within following tolerances:

Barometric Altitude Indicators

ALT - ±20-ft.

Airspeed/Mach Indicators

AIRSPEED - ±5-knots.

Vmo - ±6-knots.

MACH - ±0.010-Mach.

(f) On F/O INSTRUMENT SOURCE SELECT panel, press ALTN AS/M and ALT switchlights to normal (not lighted).

F. Test Completion

(1) Disconnect hoses from pitot-static testers and adapters, remove all adapters from pitot-static probes and stow in tester.

(2) Install caps on both tester PITOT and STATIC fittings.

(3) After completion of test, flap load relieving computer must be reset as follows: In FESC, center rack, set FLRS computer BITE switch to RESET for 5-seconds then return to RUN. Verify ADC fail indicator on FLRS computer has reset (Black).

(4) Close circuit breakers opened in Step 4A(5), (6), and (7).

(5) Turn electrical power OFF (Ref. 24-00-00).

SAT/TAS Chart
Table 502

PROBE TEMP °C	M - .407		M - .791		M - .900 (SELF TEST)	
	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS
-5	-14	256	-35	476	-42	533
-4	-13	256	-34	477	-41	534
-3	-12	257	-33	478	-41	535
-2	-11	257	-32	478	-40	536
-1	-10	257	-31	479	-39	537
0	-9	258	-30	480	-38	538
1	-8	258	-29	481	-37	539
2	-7	259	-29	482	-36	540
3	-6	259	-28	483	-35	541
4	-5	260	-27	484	-35	542
5	-4	260	-26	485	-34	543
6	-3	261	-25	486	-33	544
7	-2	261	-24	486	-32	545
8	-1	262	-23	487	-31	546
9	0	262	-22	488	-30	547
10	1	263	-21	489	-29	548
11	2	263	-21	490	-29	549
12	3	263	-20	491	-28	549
13	4	264	-19	492	-27	550
14	5	264	-18	492	-26	551
15	6	265	-17	493	-25	552
16	7	265	-16	494	-24	553
17	8	266	-15	495	-23	554
18	9	266	-14	496	-23	555
19	10	267	-13	497	-22	556
20	11	267	-13	498	-21	557
21	12	268	-12	498	-20	558
22	13	268	-11	499	-19	559
23	14	268	-10	500	-18	560
24	14	269	-9	501	-17	561
25	15	269	-8	502	-16	562
26	16	270	-7	503	-16	563
27	17	270	-6	503	-15	564
28	18	271	-5	504	-14	565
29	19	271	-5	505	-13	566

SAT/TAS Chart (Cont)
Table 502

PROBE TEMP °C	M - .407		M - .791		M - .900 (SELF TEST)	
	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS	SAT °C	TAS KNOTS
30	20	272	-4	506	-12	567
31	21	272	-3	507	-11	567
32	22	273	-2	508	-10	568
33	23	273	-1	508	-10	569
34	24	273	0	509	-9	570
35	25	274	1	510	-8	571
36	26	274	2	511	-7	572
37	27	275	3	512	-6	573
38	28	275	3	513	-5	574
39	29	276	4	513	-4	575
40	30	276	5	514	-4	576
41	31	277	6	515	-3	577
42	32	277	7	516	-2	578
43	33	277	8	517	-1	579
44	34	278	9	518	0	579
45	35	278	10	518	1	580
46	36	279	11	519	2	581
47	37	279	11	520	2	582
48	38	280	12	521	3	583
49	39	280	13	522	4	584

TOLERANCES: SAT ±5°C; TAS ±10 KNOTS

ANALOG AIR DATA COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-13-00 Pitot-Static System - Adjustment and Test

R 34-14-00 Analog/Digital Air Data Computer - Adjustment and Test

2. Removal/Installation

A. Removal

WARNING: IF BOTH AIR DATA COMPUTERS ARE TO BE REMOVED, OPEN AND TAG THE FOLLOWING CIRCUIT BREAKERS ON FE/SO OVERHEAD CB PANEL, FLAP LOAD RELIEF CHAN 1 (H12)
R FLAP LOAD RELIEF CHAN 2 (H20)

R NOTE: The ADC has proven to be susceptible to high ambient
R temperatures. Therefore, it is recommended whenever
R L-1011 Aircraft are on ground for one (1) hour or
R more, master radio bus switches be turned OFF and ADC
R circuit breakers be pulled under the following
R conditions:

R (1) The outside air temperature is above 80-degrees F. and
R APU and at least one air conditioning pack are
R operating.

R (2) The outside air temperature is above 65-degrees F. and
R no packs are operating.

R The above does not apply if systems are needed for
R testing or functional checking.

R (3) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag circuit breakers AIR DATA CMPTR (G8) and
R AIR DATA CMPTR (G27).

R (4) Open access door 112AB and enter forward electronic
R service center, zone 112. Locate computer No. 1 and
R No. 2 on rear avionics rack, shelf 5 (Ref. Fig. 401).

R CAUTION: DO NOT DISCONNECT DYNATUBE ADAPTERS ON ANALOG
R AIR DATA COMPUTER PITOT AND STATIC
R CONNECTORS.

CAUTION: HOWEVER, SHOULD IT BE NECESSARY TO TRANSFER PITOT AND STATIC ADAPTER ASSEMBLIES TO NEW UNIT BEING FITTED, PROCEED AS FOLLOWS:

(a) CHECK THAT "O" RING SEAL IS FITTED.

(b) TORQUE TIGHTEN ADAPTER TO A MAXIMUM OF 130-INCH LBS FOR A PREVIOUSLY USED "O" RING, OR 100-INCH LBS WHEN A NEW "O" RING IS FITTED. OVERTIGHTENING WILL DAMAGE CONNECTIONS ON FRONT OF AADC.

R (5) Break Dynatube fittings, disconnecting pitot and static lines from PITOT and STATIC connectors on front of R analog air data computer (AADC) to be removed.

R (6) Rotate fluted knobs (hold-down extractors) to their R fullest extent anti-clockwise to ensure AADC is R extracted. Disengage fluted knob securing AADC to rack R mount.

R (7) Pull AADC forward until rear connectors are disengaged R from mating connectors. Remove AADC.

NOTE: Excessive force is not required if AADC multi-contact connectors are fully disengaged in R preceding step.

R (8) Seal pitot and static ports to prevent ingress of R moisture or dirt during transit.

B. Installation

(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Position AADC on shelf, slide into place aligning rear connectors and mating connectors.

(3) Place holddown extractors over AADC hooks.

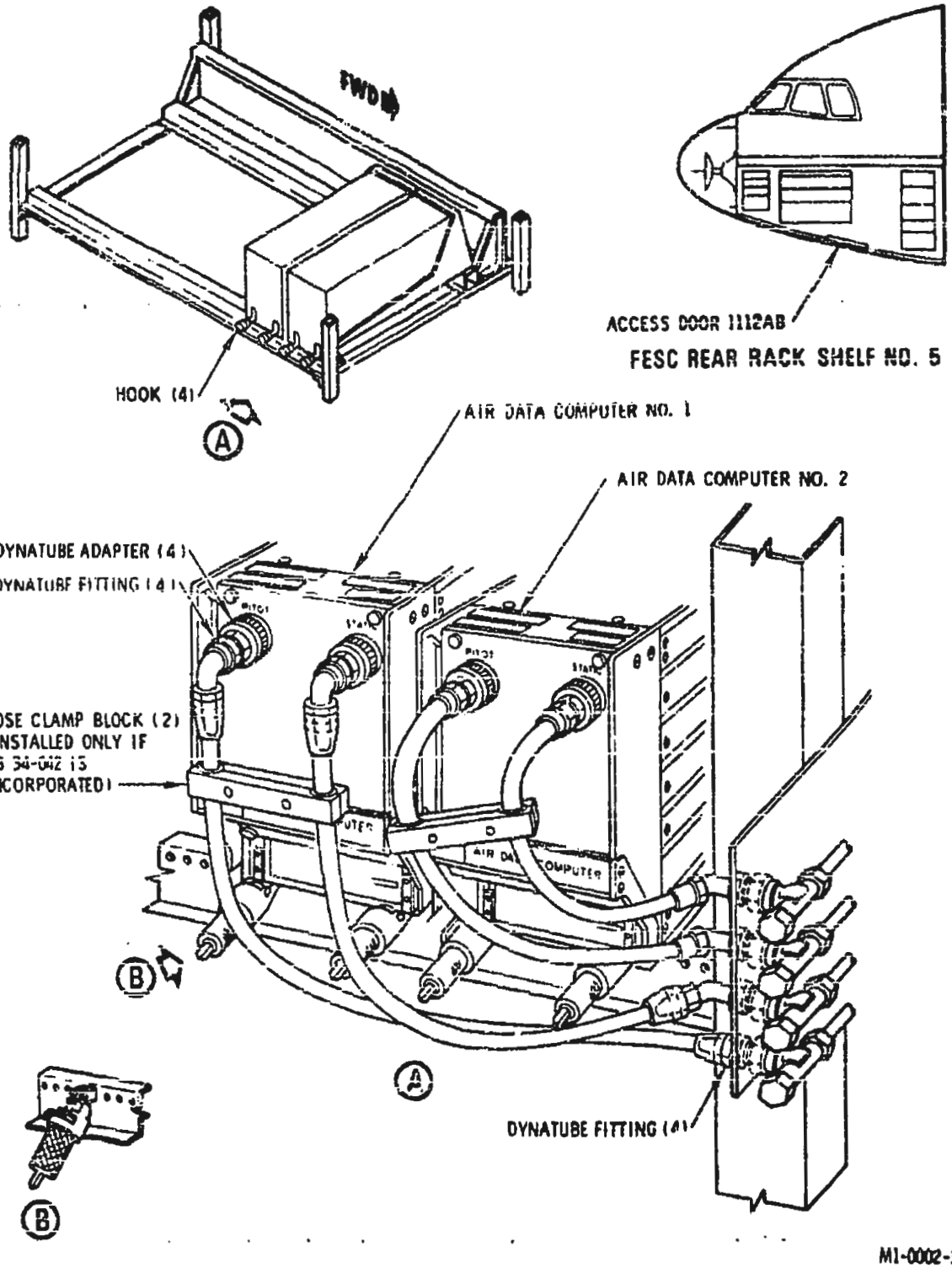
(4) Tighten fluted knobs securing AADC to shelf (mount). Unit is correctly tightened when:

(a) Fluted knobs slip on their clutch and

(b) Red band positioned between front of fluted knob and dome of hold-down unit is no longer in view.

(5) Connect pitot and static lines to PITOT and STATIC connectors on front of ADDC (Ref. Fig. 401).

(6) Close and secure access door.



C Analog Air Data Computer - Removal and Installation
C Figure 401

R EFFECTIVITY: AIRCRAFT WITH ANALOG ADC
R

(7) Remove tags and close circuit breakers opened in Step A(1).

If both ADDCs were removed, remove tags and close circuit breakers on FE/SO overhead CB panel, FLAP LOAD RELIEF CHAN 1 (H12) and CHAN 2 (H20).

(8) Perform pitot-static leak check on Captains primary pitot-static system if AADC No. 1 was replaced or First Officers primary pitot-static system if AADC No. 2 was replaced (Ref. 34-13-00).

(9) Perform AADC SELF-TEST procedure on AADC that was replaced (Ref. 34-14-00, Adjustment and Test procedure, Step 4C).

CR (10) If a CADC was replaced due to an altitude reporting
CR problem, perform the ATC system operational test (Ref.
CR 34-53-00).

DIGITAL AIR DATA COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-13-00 Pitot-Static System - Adjustment and Test

34-14-00 Analog/Digital Air Data Computer - Adjustment and Test

NOTE: The digital ADC (DADC) is interchangeable with an analog ADC and can operate in a mixed configuration.

This does not apply to dash 500 aircraft.

If a DADC is installed without Service Bulletin 34-092 incorporated, which adds cooling air to DADCs, degraded reliability of DADC may be experienced. Digital ADCs may not appear in your fleet; however, analog ADCs are no longer being manufactured and there is this possibility.

2. Removal/Installation

A. Removal

WARNING: IF BOTH DIGITAL AIR DATA COMPUTERS ARE TO BE REMOVED, OPEN AND TAG THE FOLLOWING CIRCUIT BREAKERS ON FE/SO OVERHEAD CB PANEL, FLAP LOAD RELIEF CHAN 1 (H12) FLAP LOAD RELIEF CHAN 2 (H20)

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AIR DATA CMPTR (G8) and AIR DATA CMPTR (G27).

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate computer No. 1 and
R No. 2 on rear avionics rack, shelf 5 (Ref. Fig. 401).

(3) Break Dynatube fittings, disconnecting pitot and static lines from PITOT and STATIC connectors on front of digital air data computer to be removed.

(4) Rotate fluted knobs (hold-down extractors) to their fullest extent anti-clockwise to ensure DADC is extracted. Disengage fluted knob securing DADC to rack mount.

(5) Pull DADC forward until rear connectors are disengaged from mating connectors. Remove DADC.

NOTE: Excessive force is not required if DADC multi-contact connectors are fully disengaged in above Step.

(6) Seal pitot and static ports to prevent ingress of moisture or dirt during transit.

B. Installation

(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Position DADC on shelf, slide into place aligning rear connectors and mating connectors.

(3) Place holddown extractors over DADC hooks.

(4) Tighten fluted knobs securing DADC to shelf (mount). The unit is correctly tightened when

(a) The fluted knobs slip on their clutch and

(b) The red band positioned between front of fluted knob and dome of hold-down unit is no longer in view.

(5) Connect pitot and static lines to PITOT and STATIC connectors on front of DADC (Ref. Fig. 401).

(6) Close and secure access door.

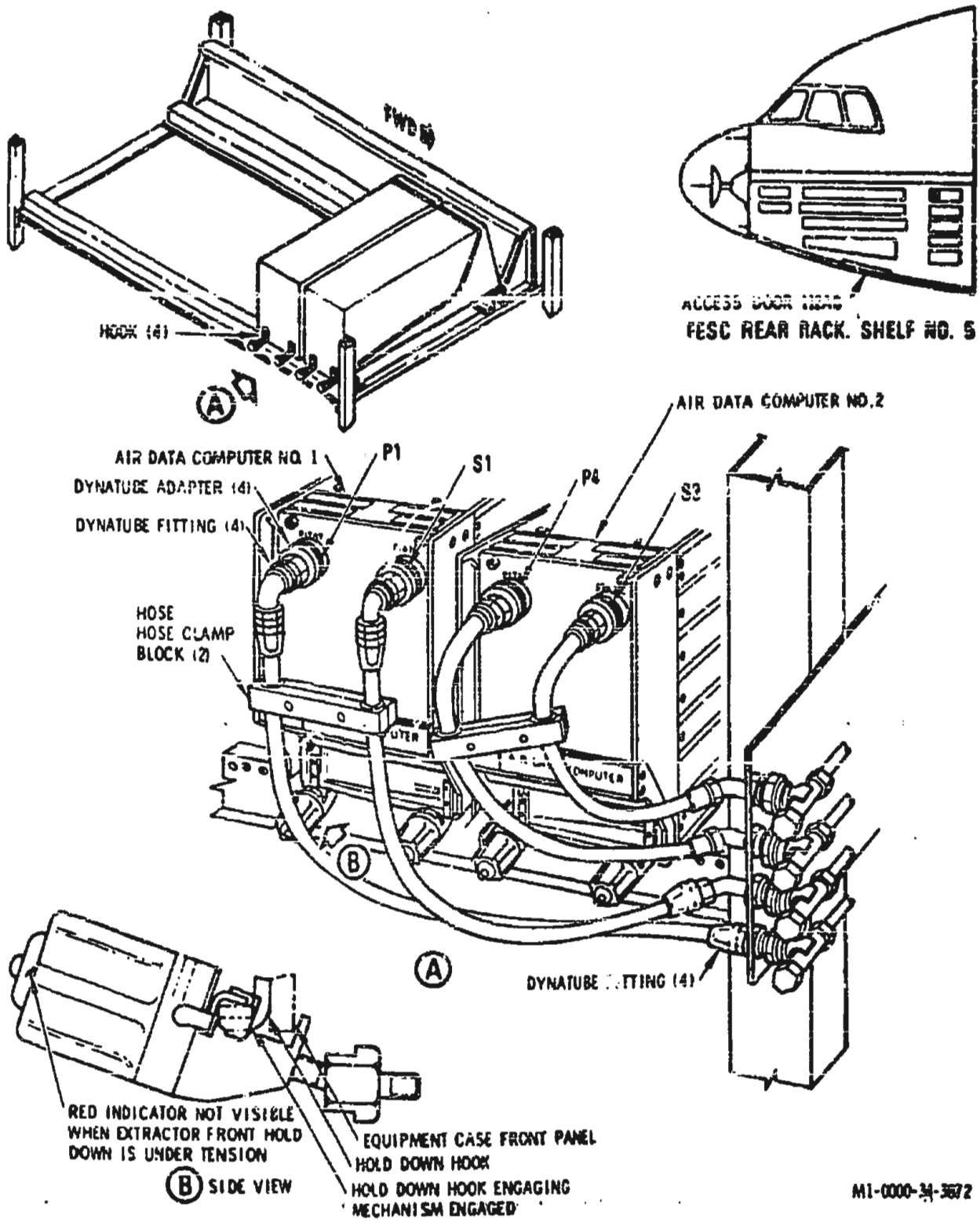
(7) Remove tags and close circuit breakers opened in Step 2A(1).

NOTE: If both DADCs were removed, remove tags and close circuit breakers on FE/SO overhead CB panel, FLAP WAD RELIEF CHAN 1 (H12) and CHAN 2 (H20).

(8) Perform pitot-static leak check on Captains primary pitot-static system if DADC No. 1 was replaced or First Officers primary pitot-static system if DADC No. 2 was replaced (Ref. 34-13-00)

(9) Perform ADC BITE procedure on DADC replaced (Ref. 34-14-00, Adjustment and Test procedure, Step 4D).

CR (10) If a CADC was replaced due to an altitude reporting
CR problem, perform the ATC system operational test (Ref.
CR 34-53-00).



R Digital Air Data Computer - Removal and Installation
R Figure 401

R EFFECTIVITY: AIRCRAFT WITH DIGITAL ADC

BAROMETRIC ALTITUDE INDICATOR (SERVOED) - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-14-00 Air Data Computer System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers as necessary:

      ALTM (F4) or ALTM (F22)

      5 VAC INSTRUMENT LIGHTING - R (L21) or R (L25)

      (2) Locate barometric altitude indicator on Captains instrument panel, zone 211, or First Officers instrument panel, zone 212, (Ref. Fig. 401).

      (3) Loosen clamp screws securing barometric altitude indicator to Captains or First Officers instrument panel.

      (4) Pull barometric altitude indicator out of recess in instrument panel and disconnect rear connector from mating connector.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

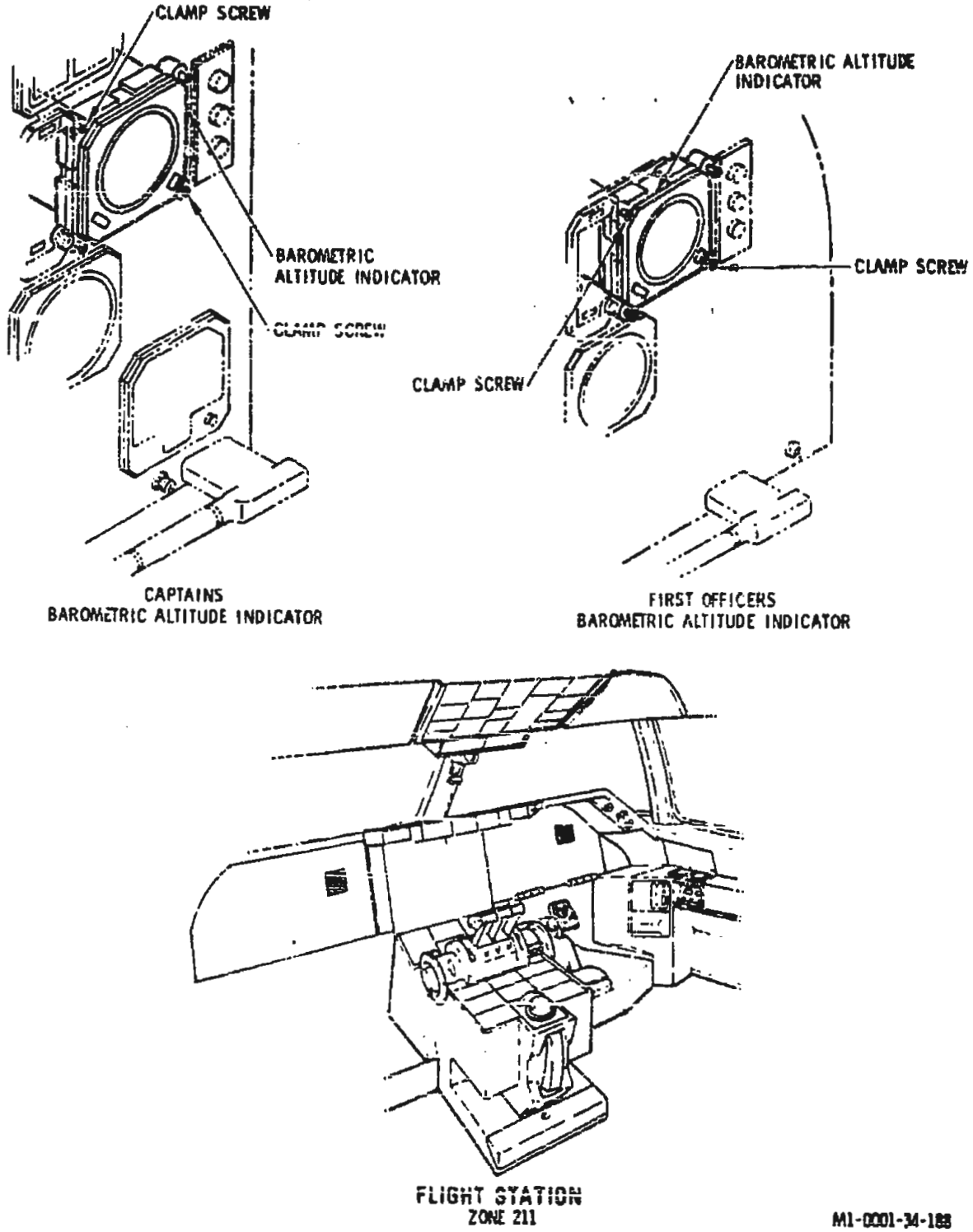
      (2) Install connector on rear of indicator.

      (3) Place barometric altimeter into recess in Captains or First Officers instrument panel and slide into place.

R R (4) On face of instrument panel, torque clamp adjusting screws to 5 to 8 lb in.

      (5) Remove tags and close circuit breakers opened in Step 2A(1).

      (6) Perform air data computer BITE test (Ref. 34-14-00).



R Barometric Altitude Indicators (Servoed)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

AIRSPEED/MACH INDICATOR - ALTERNATE VMO SETTING MAINTENANCE PRACTICE

1. General

The airspeed/Mach indicators are provided with a mechanically variable (2 position) VMO pointer (Ref. Fig. 201). The two positions are normal (375 knots) and limited (270 knots).

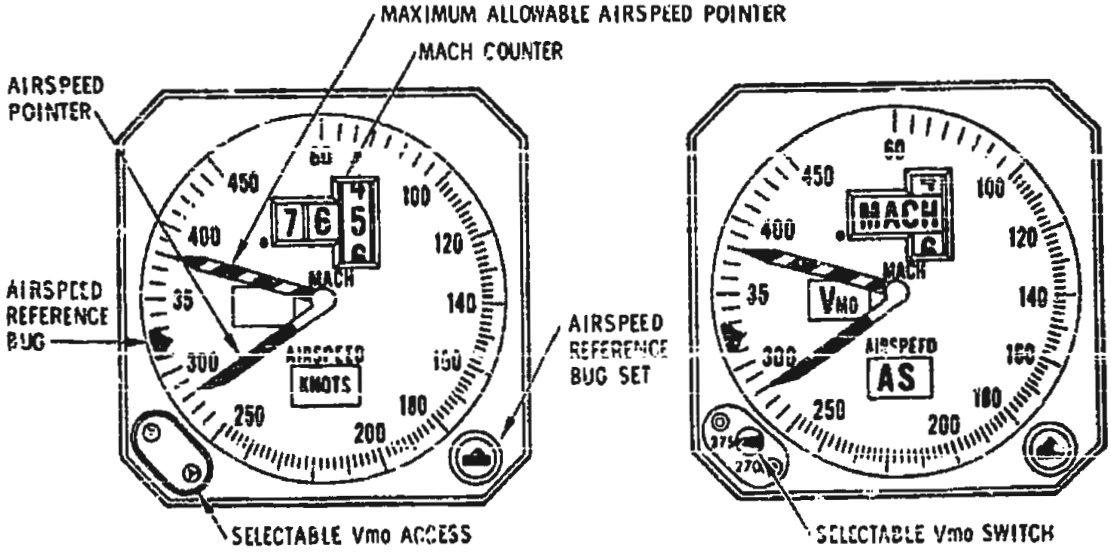
2. VMO Setting

A. Remove two screws securing access panel on lower-left hand corner of AS/M indicator and remove panel (Ref. Fig. 201).

B. Using screwdriver, position setscrew to 270 or 375 position as required.

R NOTE: VMO setscrew must be in 270 knot position for gear down flight.

C. Verify VMO pointer position coincides with setscrew position
R (270 or 375 knots).



Airspeed/Mach Indicator
Figure 201

D. Install access cover and secure with two screws.

NOTE: VMO pointer will indicate between 350 to 375 knots in 375 knot position depending on field elevation.

AIRSPEED/MACH INDICATOR (SERVOED) - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-14-00 Air Data Computer System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers:

      IAS/MACH (F1) or IAS/MACH (F19)

      5 VAC INSTRUMENT LIGHTING - L (L20) or L (L24)

      (2) Locate airspeed/Mach indicator on Captains instrument panel, zone 211, or First Officers instrument panel, zone 212. (Ref. Fig. 401).

      (3) Loosen clamp screws securing airspeed/Mach indicator to Captains or First Officers instrument panel.

      (4) Pull airspeed/Mach indicator out of recess in instrument panel and disconnect two connectors from receptacles. Remove airspeed/Mach indicator.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

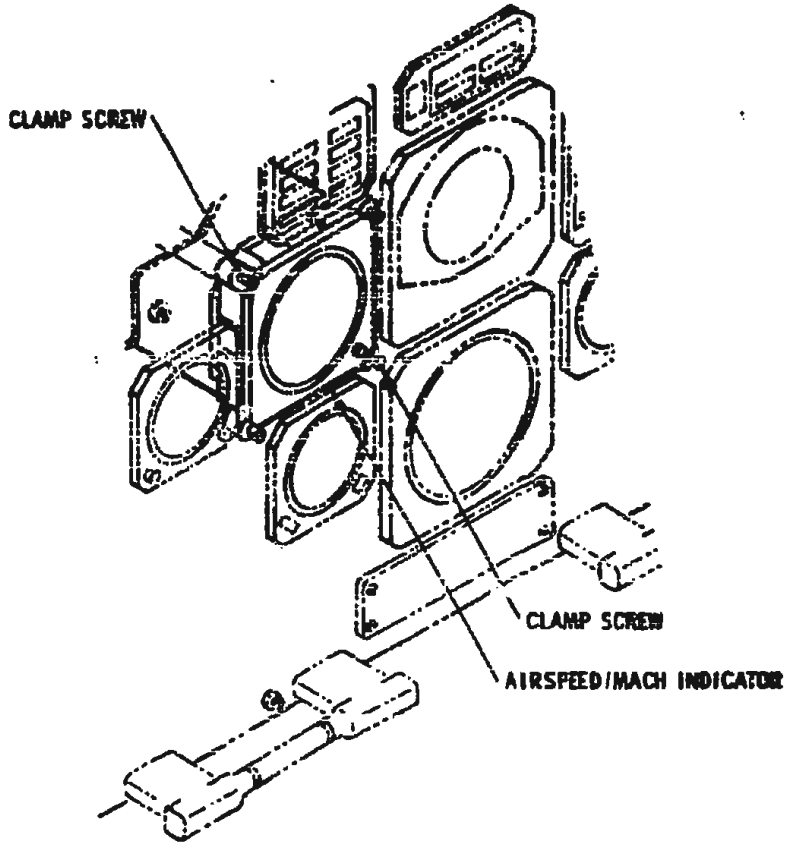
      (2) Connect two connectors to mating receptacles on airspeed/Mach indicator.

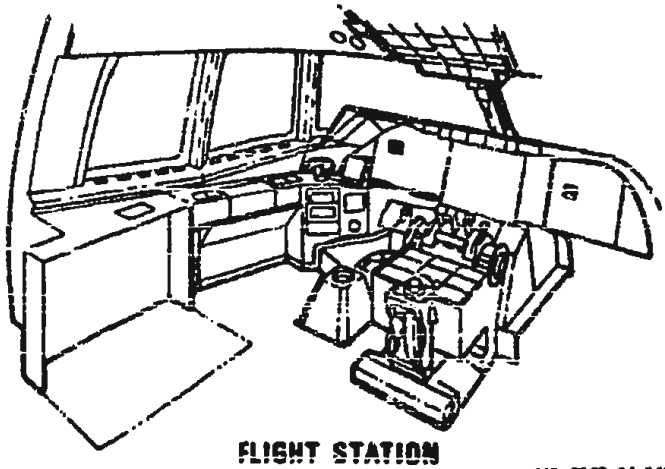
R R (3) Place airspeed/Mach indicator in recess on Captains or First Officers instrument panel.

R R (4) On face of instrument panel, torque clamp adjusting screws to 5 to 8 lb in.

R R (5) Remove tags and close circuit breakers opened in Step 2A(1).

R (6) Perform air data computer BITE test (Ref. 34-14-00).





R Airspeed/Mach Indicator (Servoed)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

VERTICAL SPEED INDICATOR (VSI) - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-14-00 Air Data Computer System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers:

      VERT SP IND (E4)

      or VERT SP IND (E21)

      5 VAC INSTRUMENT LIGHTING - R (L21), or R (L25)

      (2) Locate VSI on Captains instrument panel, zone 211 or First Officers instrument panel, zone 212, (Ref. Fig. 401).

      (3) Loosen clamp screws securing VSI to Captains or First Officers instrument panel.

      (4) Pull VSI out of recess in instrument panel, and disconnect connector from receptacle. Remove VSI.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

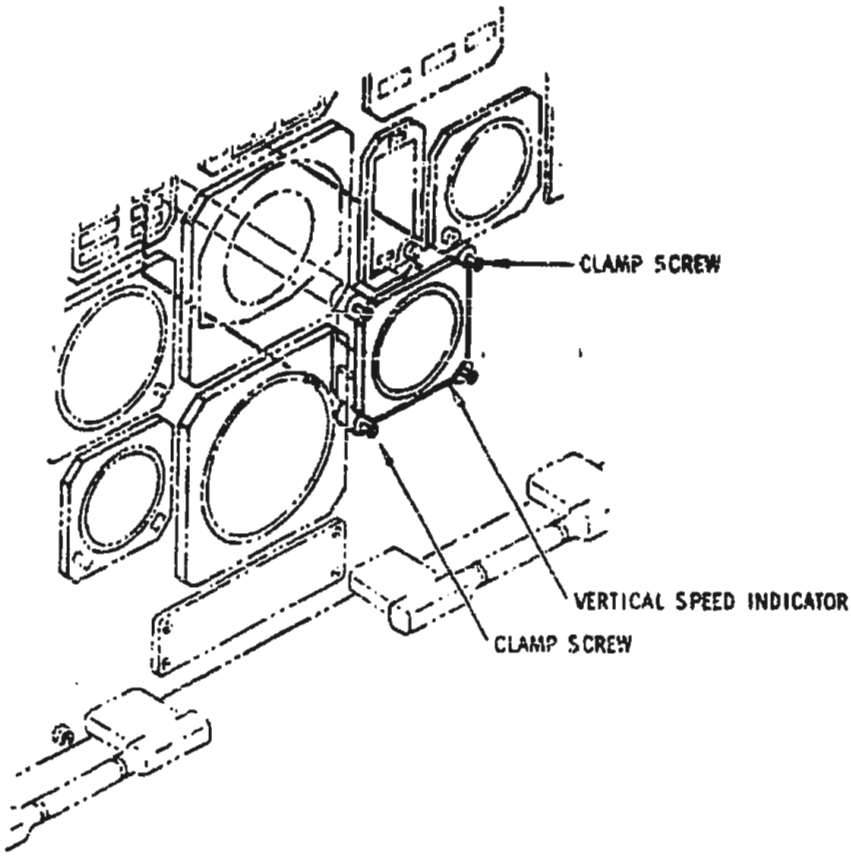
      (2) Install connector on receptacle on rear of indicator.

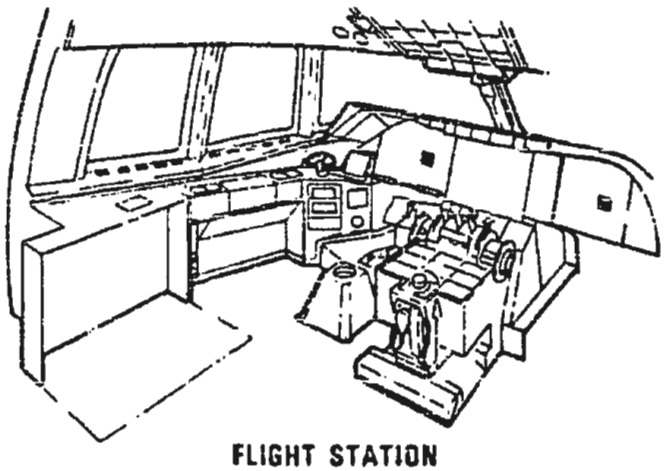
R R (3) Place VSI in recess on Captains or First Officers instrument panel.

R R (4) On face of instrument panel, torque clamp adjusting screws to 5 to 8 lb in.

R R (5) Remove tags and close circuit breakers opened in Step 2A(1).

R (6) Perform air data computer BITE test (Ref. 34-14-00).





FLIGHT STATION
ZONE 211

M1-0101-34-169

Vertical Speed Indicator - Removal and Installation
Figure 401

TOTAL AIR TEMPERATURE SENSOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Soft clean cloths

Plastic scraper

Gloves, disposable (MIL-G-36281), or equivalent

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

Environmental seal, non-conductive aluminum colored polysulfide sealant (LAC Spec C-40-1279), or equivalent

2. Reference Procedures

30-31-00	Air Data Sensor Heat System - Adjustment and Test
34-14-00	Air Data Computer System - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AIR DATA CMPTR (G8) or AIR DATA CMPTR (G27).

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers ANTI-ICE - TOTAL TEMP L (E19) or R (E20).

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TAT/EPR (R12).

(4) Locate two total air temperature sensor probes at bottom forward section of aircraft fuselage, zone 112, BL 14, FS 139, (Ref. Fig. 401). Captains on left First Officers on right.

R (5) On aircraft 001-031,
R remove bolts securing total air temperature sensor to
R fuselage. Remove total air temperature sensor and
R single gasket.

R R (5) On aircraft 032-999, remove bolts, washers, and O-rings securing total air temperature sensor to fuselage. Remove total air temperature sensor and both gaskets.

(6) Lower total air temperature sensor far enough to disconnect connector from receptacle.

WARNING: USE METHYL-ETHYL-KETONE IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN AND/OR EYE IRRITATION.

(7) Use plastic scraper to remove sealant from fuselage structure. Use soft clean cloth moistened with methyl-ethyl-keytone solvent and wipe fuselage structure clean.

B. Installation

(1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

Verify circuit breakers on CB1 rows A and 3A through 9 or 19 through 27 are closed.

R R (2) On aircraft 001-031, install gasket on total air temperature sensor.

R R (2) On aircraft 032-999, install both gaskets on total air temperature sensor.

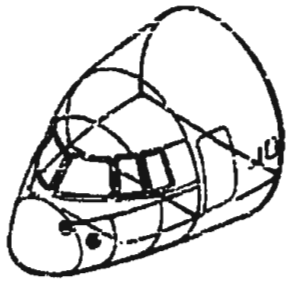
(3) Install connector on receptacle on total air temperature sensor.

WARNING: USE TRICHLOROETHANE IN WELL VENTILATED AREA. DO NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS, LUNG OR SKIN IRRITATION.

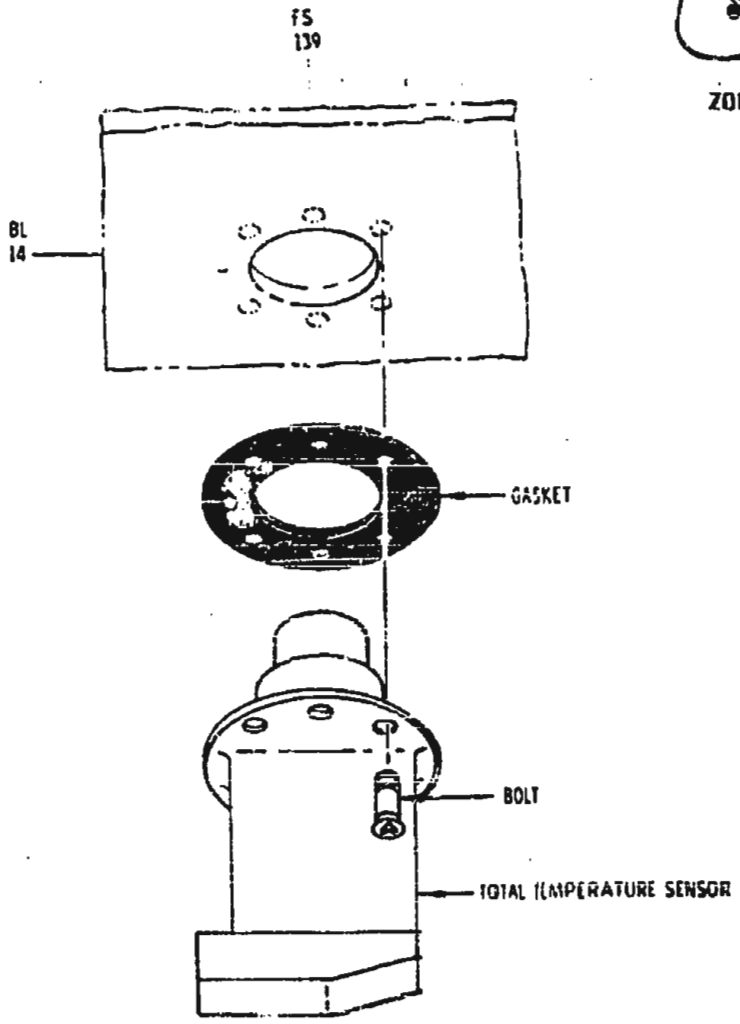
(4) Use clean soft cloth moistened with trichloroethane solvent to clean faying surfaces of fuselage skin and total air temperature probe mounting plate. Before cleaning solvent dries, wipe dry with clean rag.

(5) Position total air temperature sensor, aligning mounting holes in total air temperature sensor and gasket with fuselage mounting holes.

R R (6) On aircraft 001-031, install bolts and tighten.

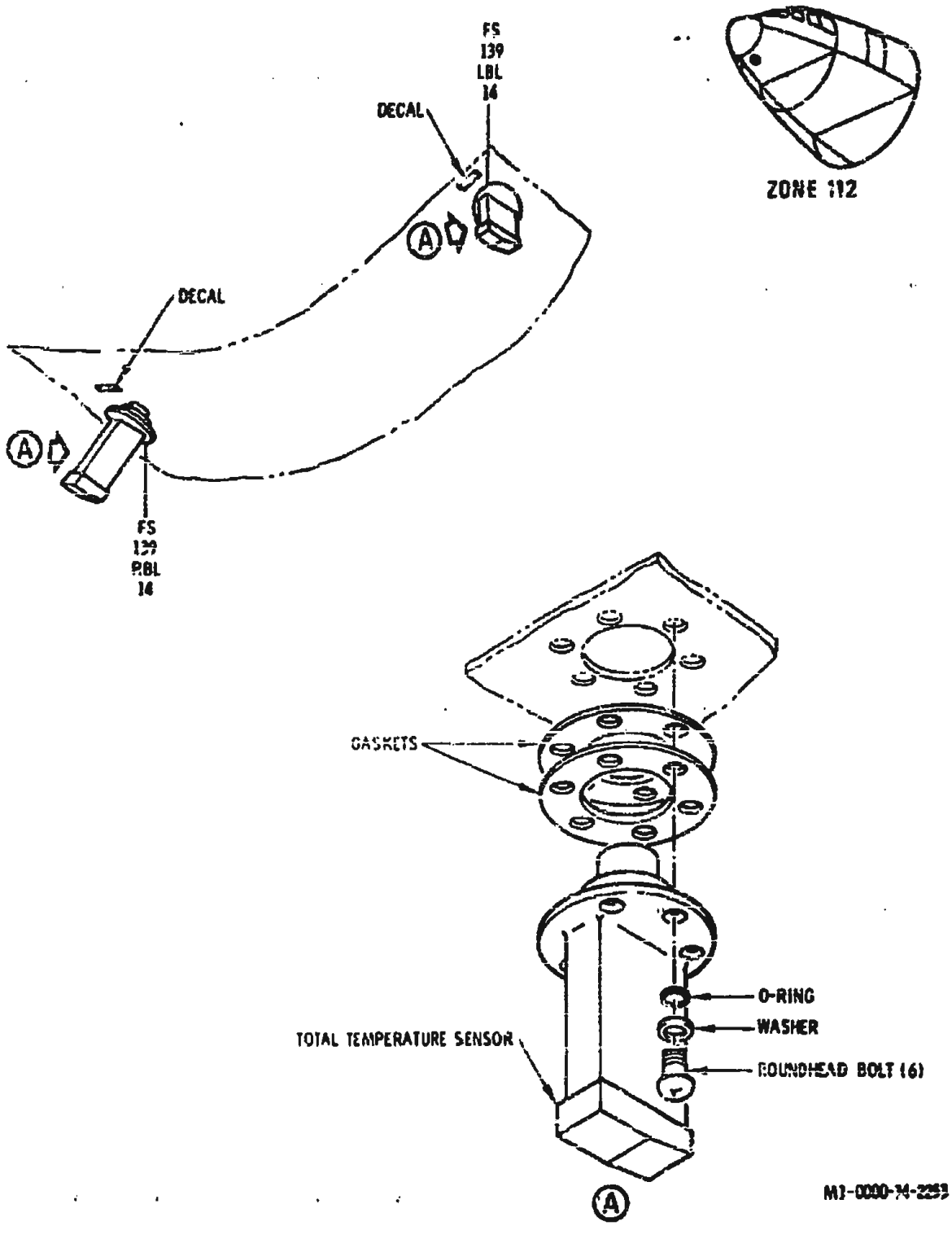


ZONE 112



HGI 5622
MI-0100-34-170

CR Total Air Temperature Sensor - Removal and Installation
CR Figure 401



CR Total Air Temperature Sensor - Removal and Installation
CR Figure 401

EFFECTIVITY: 032-999

001B

R (6) On aircraft 032,999,
R install bolts, washers, and O-rings then tighten.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(7) Wearing gloves, apply a continuous sealant fillet around base of total air temperature mounting plate and fuselage using Environmental Sealant, LAC Spec C-40-1279 or equivalent.

(8) Remove tags and close circuit breakers opened in Step 3 A(1).

(9) Perform air data sensor heat system test (Ref. 30-31-00).

(10) Turn off electrical power (Ref. 24-00-00).

TRUE AIRSPEED INDICATOR (TAS) - REMOVAL AND INSTALLATION

1. Referenced Procedures

R 34-14-00 Air Data Computer - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker:

R SAT/TAS (F27).

5 VAC INSTRUMENT LIGHTING - F/O L (L24).

(2) Locate TAS on First Officers instrument panel, zone 212, (Ref. Fig. 401).

(3) Loosen clamp screws securing TAS to First Officers instrument panel.

(4) Pull TAS out of recess in First Officers instrument panel and disconnect rear connectors from receptacles. Remove TAS.

B. Installation

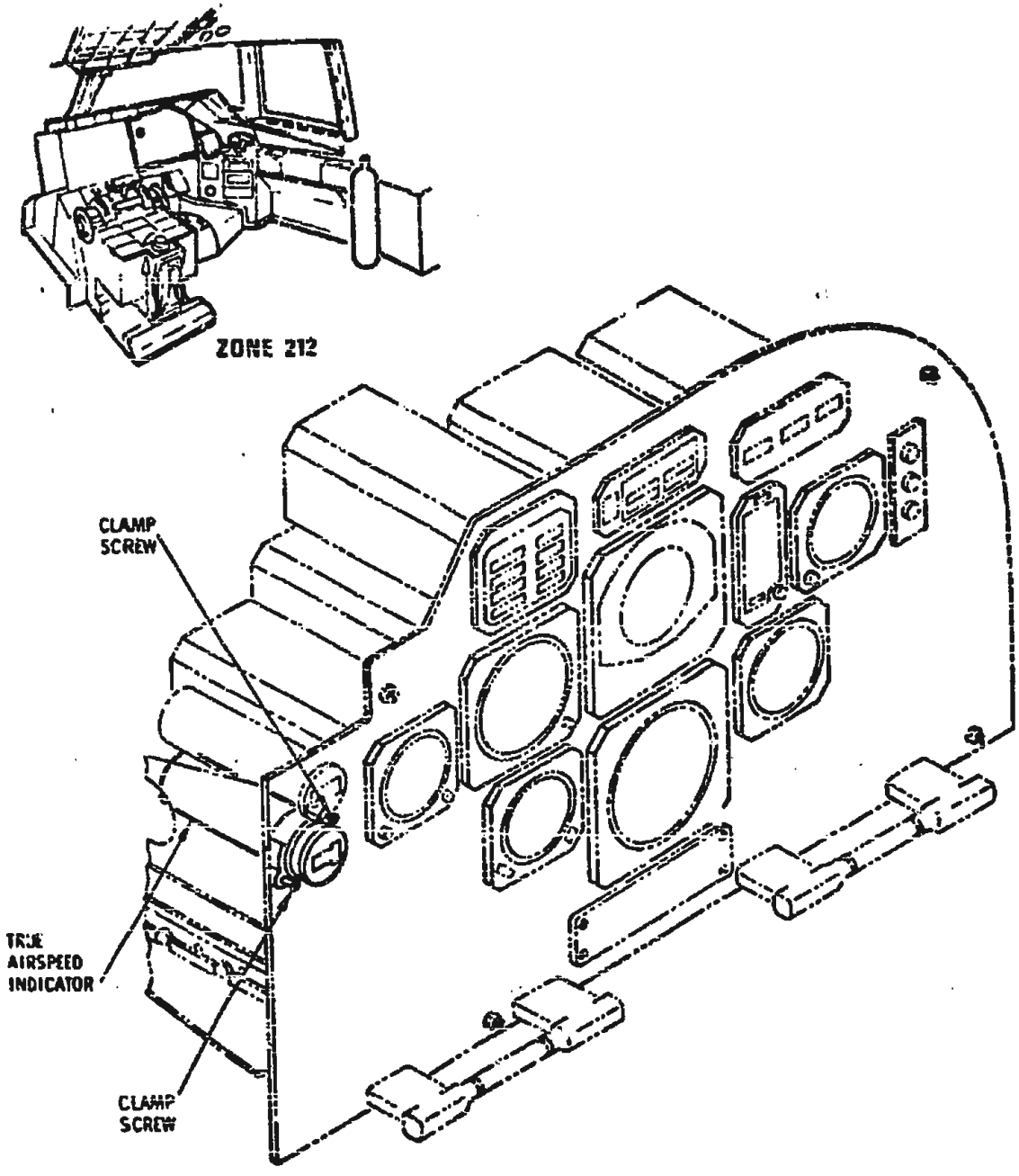
(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Reconnect rear connectors to receptacles.

(3) Place TAS into recess in First Officers instrument panel, slide into position, and secure by tightening clamp screws.

(4) Remove tags and close circuit breakers opened in Step 2A(1).

R (5) Perform air data computer system BITE test (Ref. 34-14-00).



True Airspeed Indicator (TAS) - Removal and Installation
Figure 401

AIR TEMPERATURE SYSTEM - DESCRIPTION AND OPERATION

1. General

The air temperature system is comprised of the static air temperature (SAT) indicator and the total air temperature/rated
R engine pressure ratio (TAT/EPR) indicator.

2. Static Air Temperature (SAT) Indicator

A. Description and Operation

The static air temperature indicator (Ref. Fig. 1) provides a digital display of static air temperature data as received from the air data computer system (Ref. 34-14-00). The static air temperature indicator is housed in a cylindrical envelope which contains the display counters with a PLUS and MINUS legend and the failure warning assembly. The indicator is mounted on the First Officers instrument panel, zone 212. A single electrical connector provides system interface.

115V ac, 400 Hz is supplied to the static air temperature indicator by closing circuit breaker SAT/TAS (F27) on the pilots overhead circuit breaker panel CB1, zone 210. The SAT display is a servo-driven dual two-drum counter which displays temperature in degrees C. A MINUS/PLUS shutter is actuated by a center drum as the counter passes 0 degrees C. The input shaft rotates once per degree to drive the unit drums through an additional transfer. This causes the unit drums to move in increments of 1 degree C. The counter always displays integral values, except during engagement of the transfer mechanism. The servo is driven by a dc torque motor using potentiometer feedback. The indicator displays two digits over a range of -99 degrees to +50 degrees C.

The failure warning assembly consists of the failure monitor and failure flag. The failure monitor controls the flag which is held out of view by an energized solenoid. The flag will appear if any of the following conditions occur:

Absence of primary power

Internal power supply failure

Persistent excessive servo null

Absence of static air temperature signal

Static air temperature signal out of operational limits

R NOTE: If total air temperature probe heaters are left
R on while aircraft is on the ground, the SAT and
R TAT flags will come into view.

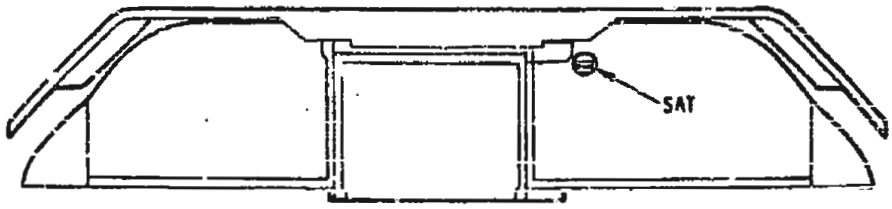
Absence of external data valid signal

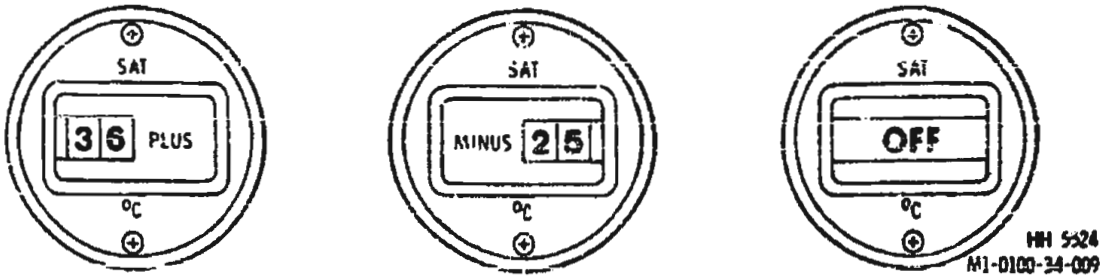
The failure flag obscures the counter display to annunciate a failure by presenting a black OFF legend on a red background.

3. Total Air Temperature/Rated Engine Pressure Ratio (TAT/EPR) Indicator

A. General

The TAT/EPR indicator displays total air temperature and rated engine pressure ratio information. The indicator is mounted on the pilots center instrument panel. Refer to 77-13-00 for description.





Static Air Temperature Indicator
Figure 1

AIR TEMPERATURE SYSTEM - FAULT ISOLATION

1. General

The diagrams in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are
R defined on using fault code diagram or schematic.

If the flight crew reports a trouble using a FIRM fault code,
R the code can be found in the 34 Fault Code Index. The index
R specifies maintenance manual section, fault isolation diagram,
R and block number on the diagram where the fault isolation
R procedure should start. Schematics are included at the end of
R the section to supplement fault isolation diagrams or as aid in
R isolating a problem not covered on diagrams.

R Refer to Maintenance Manual Introduction for a more detailed
R discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system function schematics are provided, giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
R Cross Reference (WM DIA CROSS REF) Table on system function
R schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Equipment and Materials

Thermometer reading in degrees Centigrade.

3. Fault Isolation Identification

R Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide Air Temperature System and associated component locations.

Fault Isolation Diagrams and Schematics List
Table 101

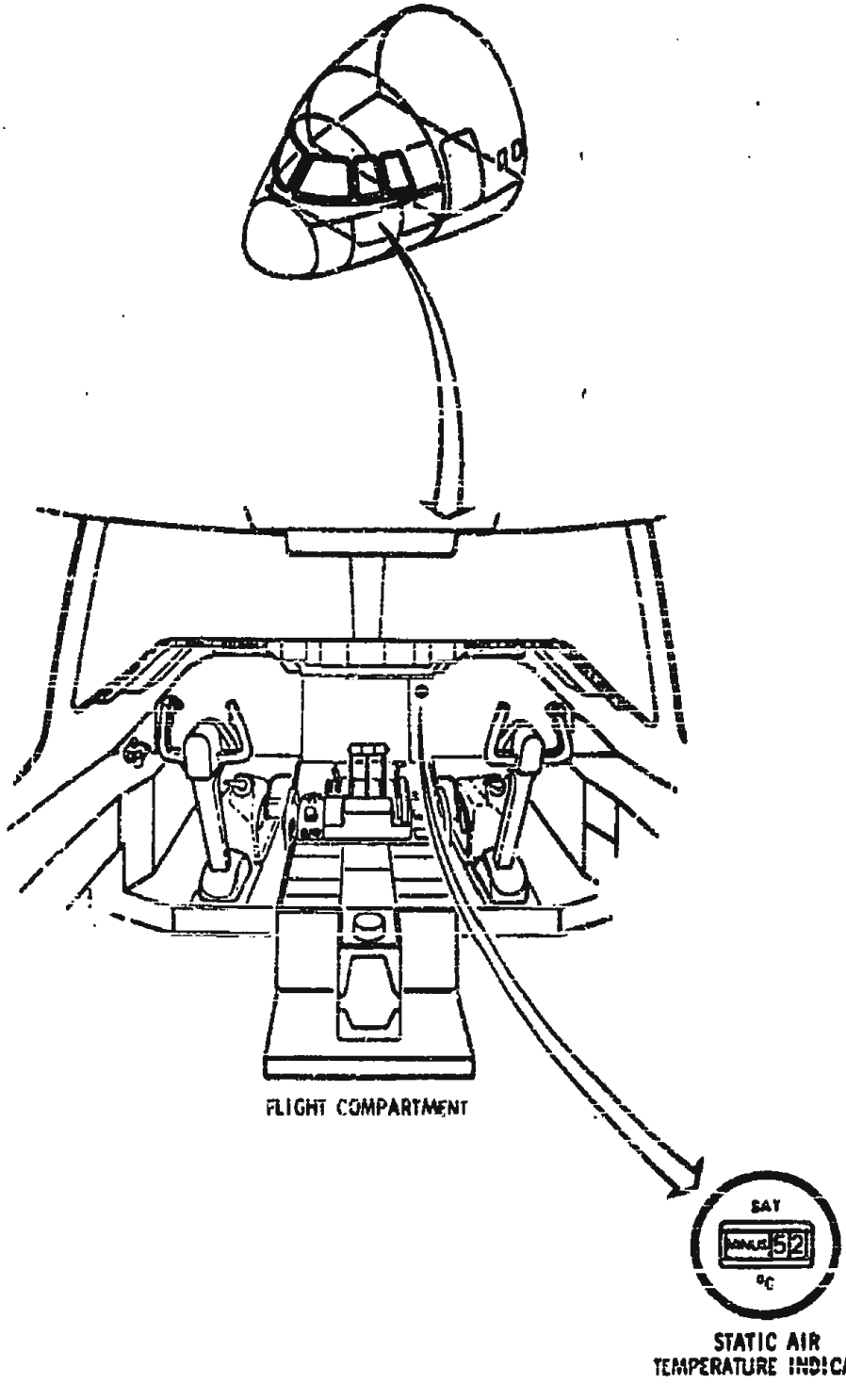
	FIGURE NUMBER	TITLE
	101	Component Location Index
	102	Component Locator Diagram
R	103	SAT/TAT Chart
	SCHEM 1	Static Air Temperature System Schematic

COMPONENT	QTY	ACCESS/AREA	REFERENCE
INDICATOR - STATIC AIR TEMPERATURE	1	FLIGHT STATION - F/O INSTRUMENT PANEL, LH SIDE	34-16-01
SENSOR - TOTAL AIR TEMPERATURE	2	LEFT AND RIGHT LOWER NOSE, AFT OF RADOME	34-14-06

M1-0000-3[illegible]-3170

R
R

Component Location Index
Figure 101



MI-31100-34-2191

Component Locator Diagram
Figure 102

R

EFFECTIVITY: ALL

001B

TAT PROBE TEMP °C	SAT °C
-6	-42
-4	-41
-3	-41
-2	-40
-1	-39
0	-38
1	-37
2	-36
3	-35
4	-35
5	-34
6	-33
7	-32
8	-31
9	-30
10	-29
11	-28
12	-28
13	-27
14	-26
15	-25
16	-24
17	-23
18	-23
19	-22
20	-21
21	-20
22	-19
23	-18
24	-17
25	-16
26	-16
27	-15
28	-14
29	-13
30	-12
31	-11
32	-10
33	-10
34	- 9
35	- 8
36	- 7
37	- 6
38	- 5
39	- 4
40	- 4
41	- 3
42	- 2
43	- 1
44	0
45	1
46	2
47	2
48	3
49	4

TOLERANCE SAT ± 2°C

CHART IS BASED ON ADC BEING IN SELF TEST
WITH NORMAL MACH INDICATION OF 0.9 MACH

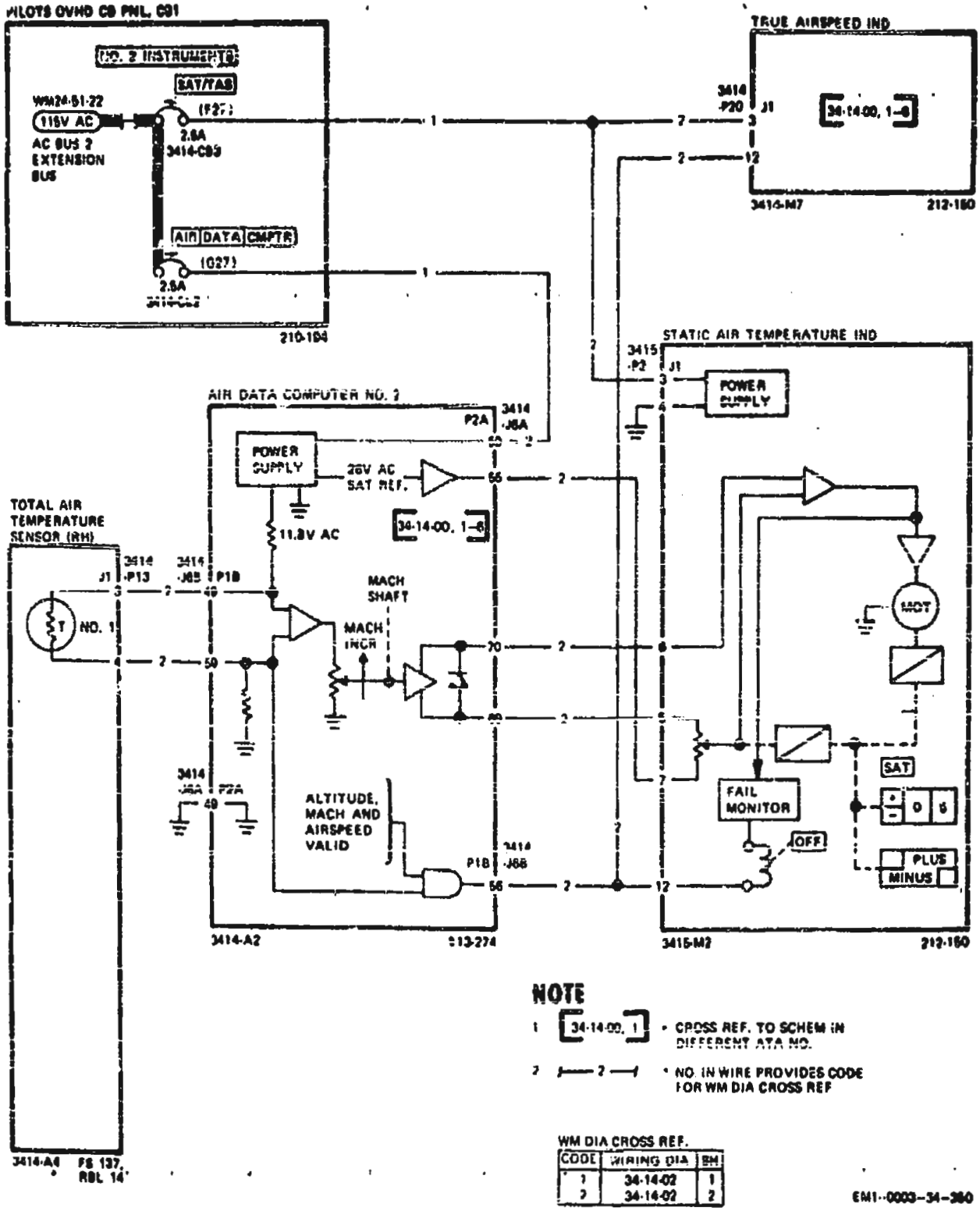
M1-0003-34-323

R
R

SAT/TAT Chart
Figure 103

EFFECTIVITY: ALL

0018



NOTE

1 [34-14-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

2 —2— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	34-14-02	1
2	34-14-02	2

EM1-0003-34-360

Static Air Temperature System Schematic
SCHEM 1

EFFECTIVITY: ALL

R
R
001B

AIR TEMPERATURE SYSTEM - ADJUSTMENT AND TEST

1. General

The air temperature system consists of a total air temperature sensing unit (probe) which supplies an input to air data computer No. 2, in turn driving a static air temperature indicator (SAT). A second sensor within the probe supplies an input to a total air temperature/rated engine pressure ratio indicator (TAT/EPR) (Ref. 77-13-00).

2. Equipment and Materials

Thermometer, ±1°C accuracy

3. Referenced Procedures

24-00-00 Electrical Power - Maintenance Practices

R 34-14-00 Air Data Computer System - Adjustment and Test

4. Adjustment/Test

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) On FE/SO ECS MONITOR panel, verify AVIONIC AIR - FWD and MID LO FLO lights are out.

R (3) If functional test is to be performed, place test thermometer next to TAT probe No. 2, FS 139, right side. Shield sensor and thermometer from direct sunlight.

R NOTE: If SB34-054 has been incorporated, place test thermometer next to TAT probe No. 1, FS139, left side.

R (4) On FE/SO aft, vertical circuit breaker panel, verify ALL ENGINES - TAT/EPR (R12) is closed.

(5) On AIR DATA SENSOR HEAT panel, on pilots overhead panel zone 210, release TEMP PROBES switchlight. Verify that the two OFF lights are on.

(6) Verify that air data computer No. 2 is operational; ensure that no flags are in view on F/O altimeter, vertical speed indicator, airspeed/Mach indicator, true airspeed indicator or static air temperature indicator (Ref. 34-14-00).

(7) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breaker SAT/TAS (F27) is closed.

B. BITE (SAT only)

(1) Perform ADC No. 2 BITE TEST (Ref. 34-14-00). Hold SELF TEST button depressed until completion of Step 4B(4).

NOTE: If a digital ADC is installed in the No. 2 position, perform SELF-TEST per 34-14-00, Adjustment and Test procedure Step 4D.

(2) After servos stop slewing (driving), record F/O MACH, SAT and TAT indicator readings.

(3) Verify that SAT indicator OFF flag is out of view.

(4) Read SAT indicator. Using MACH and TAT/EPR readings and Table 502 in 34-14-00 Adjustment and Test procedure, verify SAT indication.

(5) Release ADC No. 2 SELF TEST button.

R R (6) If Step 4C will not accomplished, perform Test Completion Step 4D.

C. Functional Test

(1) TAT

NOTE: Ensure that temperature probe heaters have been off for at least 15 minutes before proceeding with test.

(a) Allow temperature to stabilize.

(b) Verify OFF flag is out of view.

R R (c) Verify TAT/EPR indication reads within ±2 degrees C of thermometer.

(2) SAT

(a) Perform Air Data Computer functional test Step 4E in 34-14-00, Adjustment and Test. Only altitude and airspeed checks need be performed.

(b) Perform Test Completion Step 4D.

D. Test Completion

(1) Turn off electrical power (Ref. 24-00-00).

(2) Remove thermometer at TAT probe.

R STATIC AIR TEMPERATURE INDICATOR (SAT) - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 34-15-00 Air Temperature System - Adjustment and Test

R 2. Removal/Installation

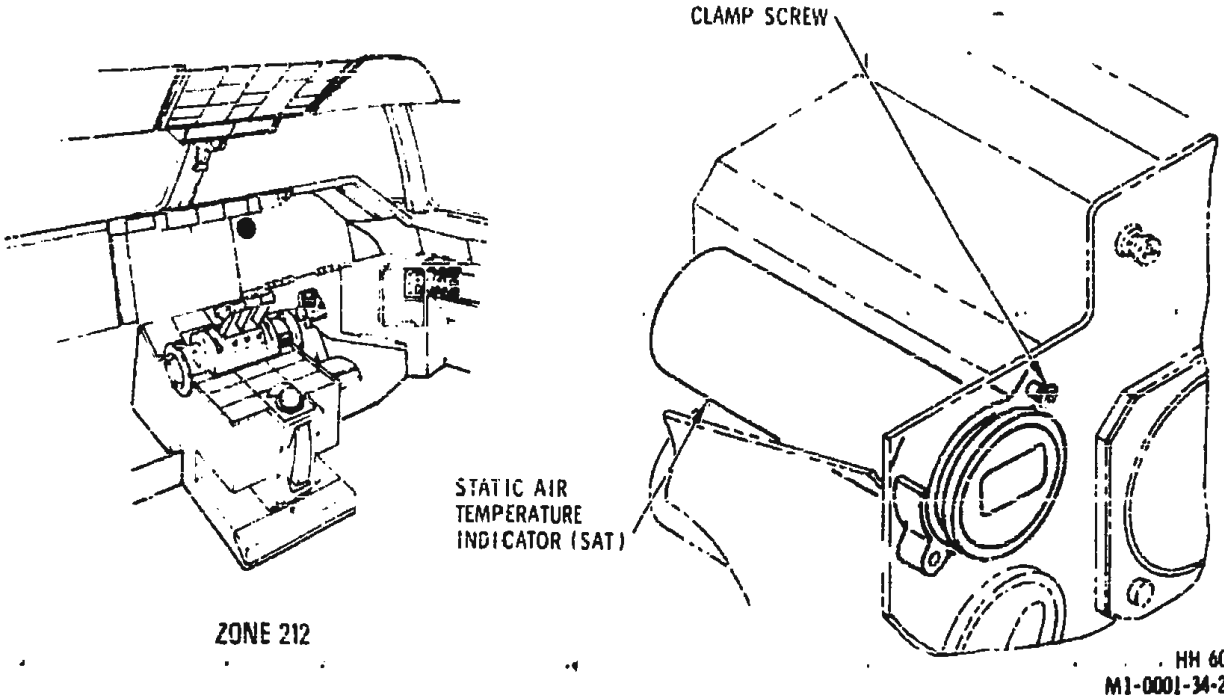
R A. Removal

R (1) On pilots overhead circuit breaker panel CB1 zone 210, R open and tag circuit breaker NO. 2 INSTRUMENTS SAT/TAS R (F27).

R (2) Locate SAT on First Officers instrument panel, zone R 212, (Ref. Fig. 401).

R (3) Loosen round head clamp screw securing SAT to First R Officers instrument panel.

R (4) Pull SAT out of recess in First Officers instrument R panel and disconnect connector from receptacle.



R Static Air Temperature Indicator (SAT)
R Removal and Installation
R Figure 401

R B. Installation

R (1) Verify that circuit breaker opened in Step 2A(1) is
R open and tagged.

R (2) Reconnect connector to receptacle.

R (3) Place SAT into recess in First Officers instrument
R panel, slide into position, and secure by tightening
R clamp screws.

R (4) Remove tags and close circuit breaker opened in Step
R 2A(1).

R (5) Perform Air Temperature System Adjustment and Test, SAT
R test (Ref. 34-15-00).

CENTRAL INSTRUMENT WARNING SYSTEM - DESCRIPTION AND OPERATION

1. General

The central instrument warning system (CIWS) consists of an instrument comparison monitor and two instrument failure warning (INSTR COMPARATOR) indicators. The comparison monitor contains four comparison monitor channels which process attitude, airspeed, altitude, and heading error information. Outputs from the four comparison monitor channels provide signals which operate visual indicators to warn the Captain and First Officer of a comparison error or equipment failure.

Comparison errors detected by the attitude monitor channel operate the ATT flag on the Captains and First Officers attitude director indicator (ADI) the VERTICAL GYRO 3 caution light on the pilots center instrument panel, and warning annunciators on the INSTR COMPARATOR indicators (Ref. Fig. 1). Outputs from the heading, barometric altitude, and airspeed comparison monitor channels operate the warning annunciators on the INSTR COMPARATOR indicators.

The instrument comparison monitor is located on shelf No. 2 of the forward rack in the forward electronic service center, zone 112. The INSTR COMPARATOR indicators are located on the Captains and First Officers instrument panel, zones 211 and 212. The VERTICAL GYRO 3 light is located in the caution and warning light assembly on the pilots center instrument panel, zone 210. (Ref. Fig. 1).

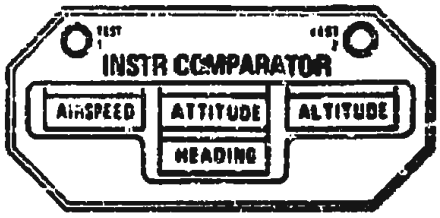
2. Operation

Four comparison monitor channels interface with the attitude director indicators (ADI), the horizontal situation indicator (HSI), the barometric altitude indicator (servoed), and the airspeed/Mach indicator (servoed) on the Captains and First Officers instrument panels (Ref. Fig. 2).

A. Attitude Comparison Monitor Channel

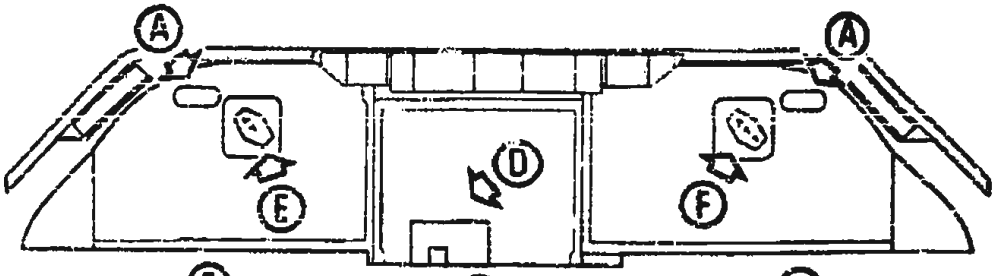
The attitude information (roll and/or pitch) will be referred to as the attitude reference system (ARS) throughout the text.

Attitude reference system (ARS) No. 1 and ARS No. 3 supply attitude data and a data valid signal to the Captains ADI. ARS No. 2 and ARS No. 3 supply attitude data and a data valid signal to the First Officers ADI. ARS No. 3 is used as the comparison reference in both ADI and is the alternate



(A)

INSTRUMENT FAILURE WARNING INDICATOR



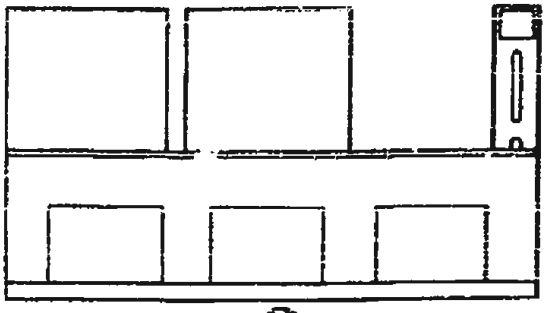
(E) CAPTAINS ADI

(B) PILOTS INSTRUMENT PANELS

(F) F/O ADI

(D)

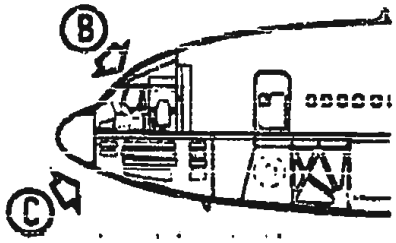
CAUTION AND WARNING LIGHTS



INSTRUMENT COMPARISON MONITOR

(C)

FORWARD ELECTRONIC SERVICE CENTER
FORWARD RACK, SHELF 2
(VIEW LOOKING FORWARD)



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R
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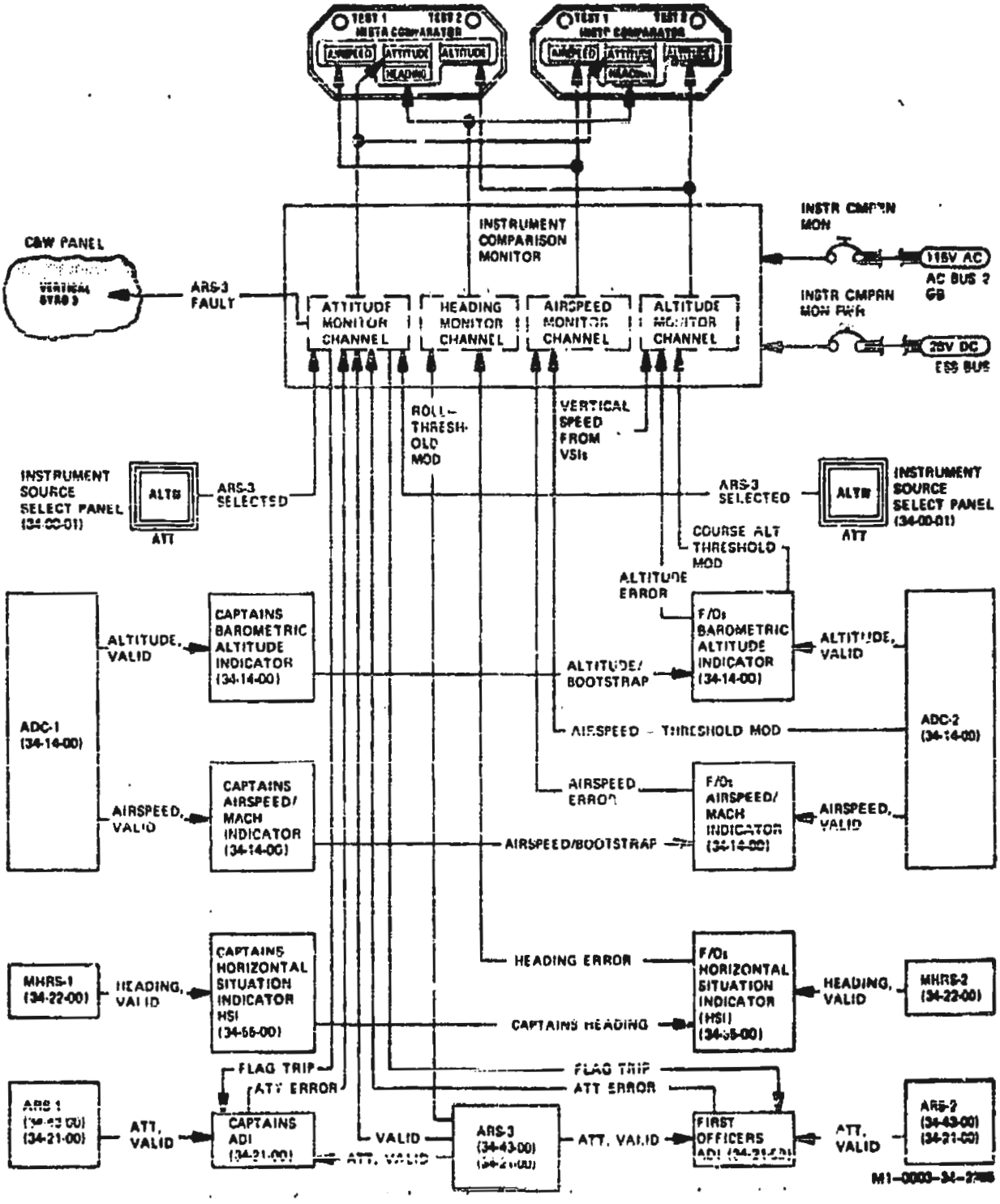
Central Instrument Warning System
Figure 1



R Central Instrument Warning System Block Diagram
R Figure 2

source of attitude information. Transolvers in the ADI combine pitch and roll position withARS No. 3 attitude data to supply attitude error to the attitude comparison monitor channel. Three threshold detectors are used to detect errors between the three attitude systems. From this information, a voting logic occurs that will identify which of the three systems is faulty. In the normal mode of operation, a comparison is made between ARS No. 1 and ARS No. 3, and between ARS No. 2 and ARS No. 3. If a comparison error is detected greater than 4.5 degrees, a 28V dc ATT flag output signal is applied to the applicable ADI, causing the ADI monitor to remove the ground on the flag solenoid and the ATT flag comes into view. If ARS No. 3 drifts out
R of limits from ARS No. 1 and ARS No. 2, 28V dc is applied to the VERTICAL GYRO 3 light (caution annunciator). Comparison failures and corresponding visual indications are as follows:

No comparison errors or failures detected: all flags are out of view, all annunciators are blank (black).

ARS No. 1 error greater than 4.5 degrees compared to ARS No. 3: Captains ADI flag in view, all annunciators are blank (black).

ARS No. 2 error greater than 4.5 degrees compared to ARS No. 3: First Officers ADI flag in view, all annunciators are blank (black).

ARS No. 3 error greater than 4.5 degrees compared to ARS No. 1 and ARS No. 2, or ARS No. 3 invalid: VERTICAL GYRO 3 indicator comes on (amber), all flags
R out of view, all annunciators are blank (black).

If a comparison error is detected between ARS No. 1 or ARS No. 2 and ARS No. 3, the Captain or First Officer may switch to ARS No. 3 by pressing the ALTN ATT switch on the INSTRUMENT SOURCE SELECT panel. When the ALTN ATT switch has been pressed, an ARS No. 3 selected signal inhibits the 28V dc ATT flag output to the ADIs and the attitude comparison monitor becomes a two gyro monitor. After the ALTN ATT switch has been pressed, a second failure detected will energize warning annunciators on the INSTR COMPARATOR indicators as follows:

ARS No. 1 or ARS No. 2 disagrees with ARS No. 3: Captains and First Officers INSTR COMPARATOR indicator displays ATTITUDE (yellow).

ADI excitation or monitor power supply failures will display the following INSTR COMPARATOR indicator annunciations:

Loss of ADI pitch or roll comparison transolver excitation: Captains and First Officers INSTR COMPARATOR indicator displays ATT MON (cross-hatched yellow).

Monitor power failure: All annunciators on both Captains and First Officers INSTR COMPARATOR indicator will display cross-hatched yellow.

B. Barometric Altitude Comparison Monitor Channel

The barometric altitude comparison monitor channel processes fine altitude error information which is resolved in the First Officers barometric altitude indicator (servoed). This processing detects comparison errors between the fine
R altitude outputs of ADC No. 1 and ADC No. 2. It can also detect defects within the two altitude indicators that would prevent normal servo operation, causing an apparent comparison error. If a comparison error is detected, a 28V dc comparison warning signal will energize the ALTITUDE (yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel. If transolver excitation in the altitude indicators is lost, a 28V dc warning signal will energize the ALT MON (cross-hatched yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel.

C. Airspeed Comparison Monitor Channel

The airspeed comparison channel processes airspeed error information which is resolved in the First Officers airspeed/Mach indicator (servoed). This processing detects
R comparison errors between the airspeed outputs of ADC No. 1
R and ADC No. 2. It can also detect defects within the two airspeed/Mach indicators that would prevent normal servo operation, causing an apparent comparison error. If a comparison error is detected, a 28V dc comparison warning signal will energize the AIRSPEED (yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel. If transolver excitation in the airspeed/Mach indicators is lost, a 28V dc warning signal will energize the AS MON (cross-hatched yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel.

D. Heading Comparison Monitor Channel

The heading comparison channel processes heading error information which is resolved in the First Officers horizontal situation indicator (HSI). This processing detects comparison errors between the compass heading outputs of magnetic heading reference system (MHRS) No. 1

and MHRS No. 2. If a comparison error is detected, a 28V dc comparison warning signal will energize the HEADING (yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel. If transolver excitation in the HSI is lost, a 28V dc warning signal will energize the HDG MON (cross-hatched yellow) display on both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel.

3. Instrument Comparison Monitor

A. Description

The instrument comparison monitor (ICM) monitors attitude, barometric altitude, airspeed, and heading outputs from the attitude director indicators, First Officers barometric altitude indicator, First Officers airspeed/Mach indicator, and First Officers horizontal situation indicator. In reality, these outputs are comparisons ofthe three attitude reference systems (ARS), the two ADC altitude and airspeed outputs, and the two MHRS heading outputs. The ICM consists of four channels (Ref. Fig. 3). If a comparison error is detected, indicator transolver excitation is lost, or the ICM power supply fails, the Captain and First Officer are (depending on the defect) warned by the ATT flag on the ADI, the annunciators on the INSTR COMPARATOR indicators, and the VERTICAL GYRO 3 light.

B. Operation

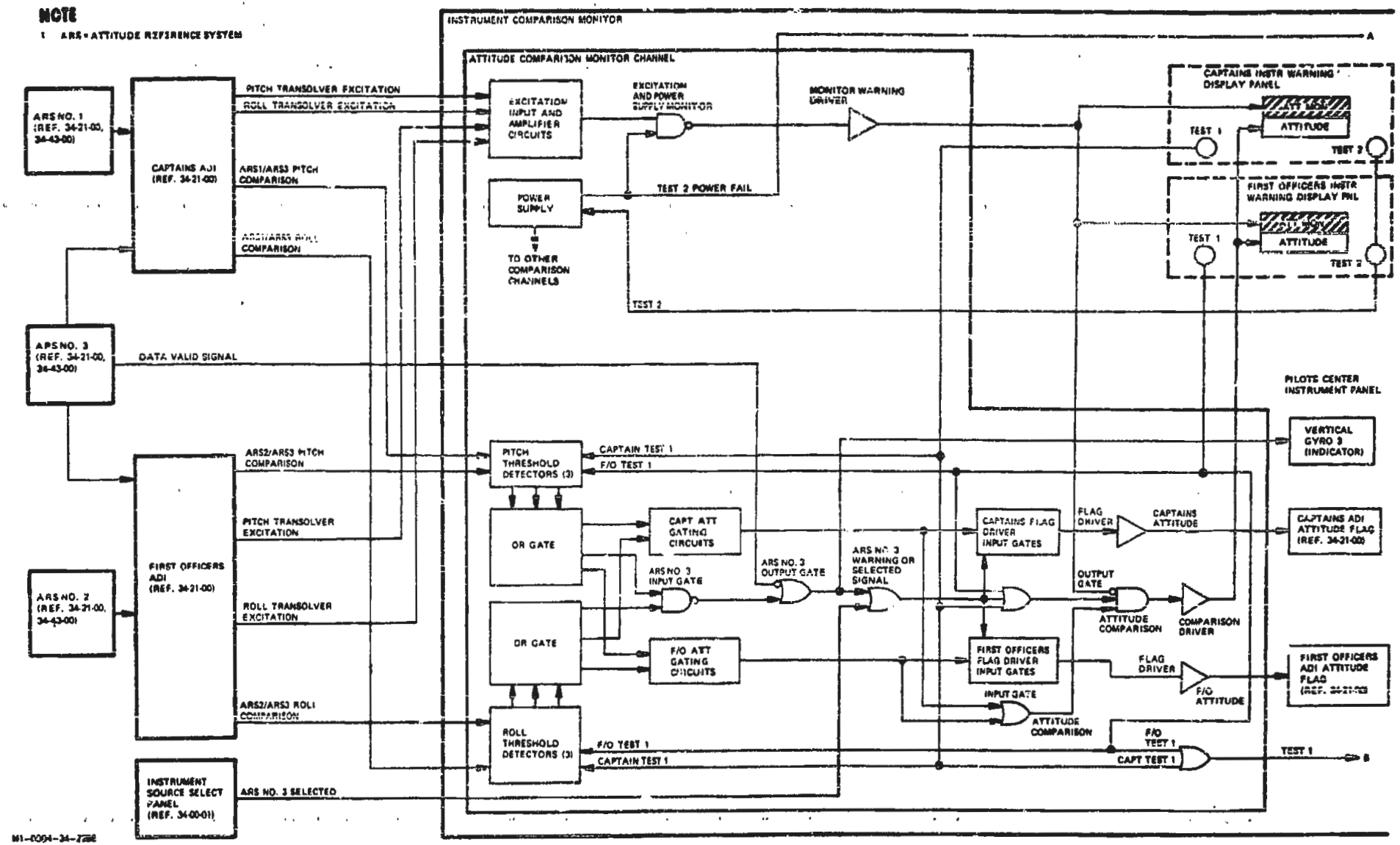
R The four comparison monitor channels detect comparison errors and transolver cosine winding excitation failures. Faulty interconnecting wiring, transolver failures, and indicator servo failures would also show up as apparent comparison errors or excitation failures. The comparison monitor channels contain error threshold detection circuits, comparison warning circuits, excitation detection circuits, and excitation failure warning circuits.

(1) Attitude Comparison Monitor Channel

R The attitude comparison monitor channel receives inputs
R from the two ADIs representing comparison of ARS1/ARS3
R and ARS2/ARS3, validity from ARS No. 3, and an ALTN ATT
R selected signal from the INSTRUMENT SOURCE SELECT panel
R (Ref. Fig. 3). Pitch and roll comparison signals from the ADI are applied to the threshold detectors. Pitch and roll signals less than the 4.5 degree tolerance between attitude reference systems results in high outputs from the threshold detectors. These high outputs are gated through OR gates, and inverted to low

NOTE

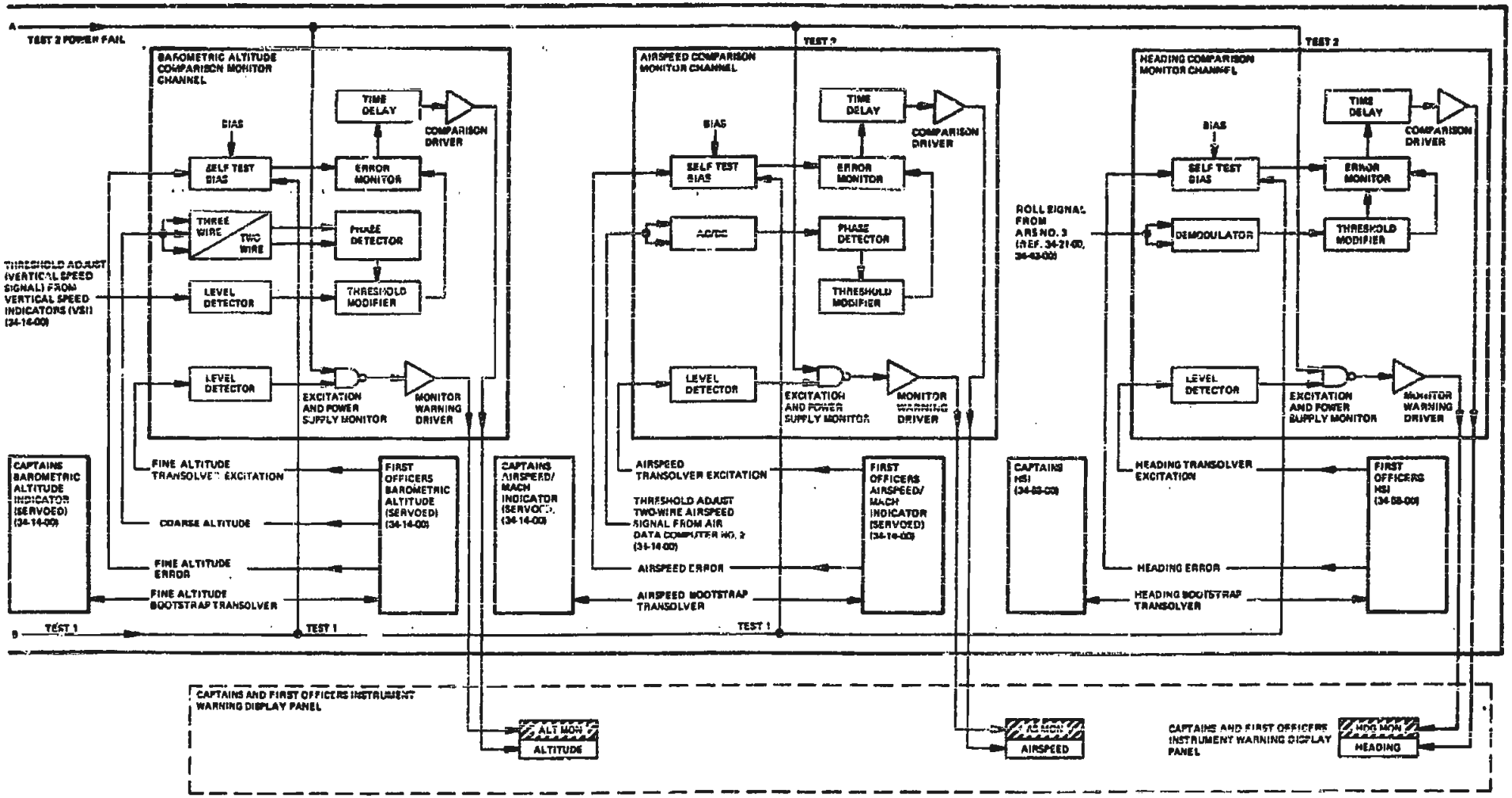
1 ARS = ATTITUDE REFERENCE SYSTEM



R Instrument Comparison Monitor Block Diagram
R Figure 3 (Sheet 1)

EFFECTIVITY: ALL

001B



M1-0003-34-1714

R Instrument Comparison Monitor Block Diagram
R Figure 3 (Sheet 2)

EFFECTIVITY: ALL

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outputs (zero V dc) in the ATT gating circuits to inhibit the flag driver input gates. The ATT flags on the ADIs are held out of view by an internal holding voltage. The high outputs from the OR gates are gated through and inverted by the ARS No. 3 input gate. The low output from this gate is gated through the ARS No. 3 output gate keeping the VERTICAL GYRO 3 light out. The low output from the ARS No. 3 warning or selected signal gate, inhibits the ATT comparison output gate and the Captains and First Officers flag drivers. The three-sided ATTITUDE-ATT MON annunciators on the INSTR COMPARATOR indicators remain blank (black).

If the threshold detectors detect a comparison error greater than 4.5 degrees, a low output is gated through the OR gates and inverted by the gating circuits to enable the applicable flag driver input gate. The flag driver provides a drive signal to release the holding voltage on the ATT flag circuit. The ATT flag on the Captains or First Officers ADI comes into view.

If a comparison error developed between ARS No. 1/ARS No. 2 and ARS No. 3, the ARS No. 3 input gate output will go high. Also, if a failure occurs in ARS No. 3, the ARS No. 3 data valid signal drops to a low signal. This low signal is gated through and inverted by the ARS No. 3 output gate to light the VERTICAL GYRO 3 indicator (Ref. 34-21-00). Simultaneously, this high output is gated through the ARS No. 3 warning gate to inhibit the flag driver gates.

After a comparison error has been detected, indicated by the ATT flag on the applicable ADI in view, the Captain and/or First Officer can switch to alternate attitude inputs by pressing the ALTN ATT switch on the INSTRUMENT SOURCE SELECT panel. This applies a high (28V dc) signal through the ARS No. 3 warning and selected signal gate. A high output from this gate is inverted in the flag driver input gates to inhibit the flag driver circuits and enable the attitude comparison output gate.

If the threshold detectors detect a comparison error after the ALTN ATT switch has been pressed, a low signal is gated through the associated OR gates, inverted by the gating circuits, and gated through the attitude comparison input and output gates to the comparison driver. The amplified output (28V dc) drives both INSTR COMPARATOR indicators to display ATTITUDE (yellow).

Loss of transolver pitch or roll excitation, or power supply failure, applies a low input to the excitation and power supply monitor. This low signal is gated through, inverted, and applied to the monitor warning driver. The amplified output (28V dc) drives both INSTR COMPARATOR indicators to annunciate ATT MON (cross-hatched yellow). This high output is sent to the attitude comparison output gate to inhibit the comparison drive circuits. Because the power supply is common to all channels, each annunciator will display cross-hatched yellow on both INSTR COMPARATOR indicators during a power input or monitor power supply failure.

R Test 1 inputs from the INSTR COMPARATOR indicator are processed through the same comparison monitor circuits as the pitch and roll inputs from the ADI. If the TEST 1 pushbutton on the Captains INSTR COMPARATOR indicator is pressed (simulated ARS No. 1 defect), the threshold detectors output drops from high to low. This low output is gated through the OR gates and inverted by the Captains attitude gating circuits. The high outputs are gated through the attitude comparison input gate to the attitude comparison output gate. To enable the attitude comparison output gate, which is normally inhibited unless an ALTN ATT has been selected, a high signal from the TEST 1 input is sent to the output gate. The high output from this gate turns on the comparison driver. The amplified comparison driver output (28V dc) drives both INSTR COMPARATOR indicators on the Captains and First Officers instrument panel to indicate ATTITUDE (yellow). At the same time, the Captains flag driver will cause the ATT flag in the Captains ADI to come into view.

If the TEST 1 pushbutton on the First Officers INSTR COMPARATOR indicator is pressed (simulated ARS No. 2 defect), the same sequence of events will take place with identical results, except the First Officers ADI ATT flag will come into view.

If the TEST 2 pushbutton on the Captains and/or First Officers INSTR COMPARATOR indicator is pressed, a low signal (ground) is applied to power fail logic in the power supply. This simulates a power failure which allows external 28V dc (aircraft supply) to activate the monitor warning driver. The amplified output drives both INSTR COMPARATORS on the Captains and First Officers instrument panel to display all annunciations cross-hatched yellow.

If the TEST 1 pushbutton on the Captains and First Officers INSTR COMPARATOR indicators are pressed simultaneously, the VERTICAL GYRO 3 indicator light comes on. This simulates an ARS No. 3 defect.

(2) Barometric Altitude Comparison Monitor Channel

The barometric altitude comparison monitor channel monitors fine altitude error information from the First Officers barometric altitude indicator (servoed) (Ref. Fig. 3). The Captains fine altitude bootstrap transolver transmits three-wire altitude information to the First Officers fine altitude bootstrap transolver. The First Officers fine altitude bootstrap transolver combines mechanical fine angle with the three-wire electrical angle to provide fine altitude comparison of air data computer (ADC) No. 1 and ADC No. 2 altitude outputs. This null or error information from the First Officers barometric altitude indicator (servoed) is fed through the self-test bias circuit to the error monitor (Ref. Fig. 3). The error monitor threshold is adjusted by three-wire coarse altitude data from the First Officers barometric altitude indicator (servoed). This three-wire data is converted to a two-wire, constant-amplitude, variable phase signal. The phase detector generates a dc voltage that varies as the variable phase signal changes around a referenced 15V ac voltage. The dc voltage increases as altitude increases, which raises the threshold level in the error monitor. A vertical speed signal from the vertical speed indicators (VSI) doubles the allowed error when the vertical speed is greater than 800 ft/min. When a vertical speed of less than 800 ft/min. is detected, the nominal altitude error required to cause a fault indication varies linearly from 100 feet at 4,000 feet mean sea level (msl), to 240 feet at 40,000 feet msl. When the vertical speed signal is greater than 800 ft/min, the nominal altitude error required to cause a fault indication will vary linearly from 200 feet at 4,000 feet msl, to 480 feet at 40,000 feet msl (Ref. Fig. 4).

If the comparison monitor channel does not detect an error or failure, the INSTR COMPARATOR indicators will indicate blank (black).

If a comparison error is detected by the error monitor, a high output signal is delayed for 2 seconds by a time delay that eliminates false tripping, and then applied to the comparison driver. The amplified output (28V dc) drives both INSTR COMPARATOR indicators to indicate ALTITUDE (yellow).

If the fine altitude transolver excitation signal drops from high to low, the level detector applies this low signal to the excitation and power supply monitor gate. This signal is gated through and inverted to turn on the monitor warning driver which drives the INSTR COMPARATOR indicators to annunciate ALT MON (cross-hatched yellow).

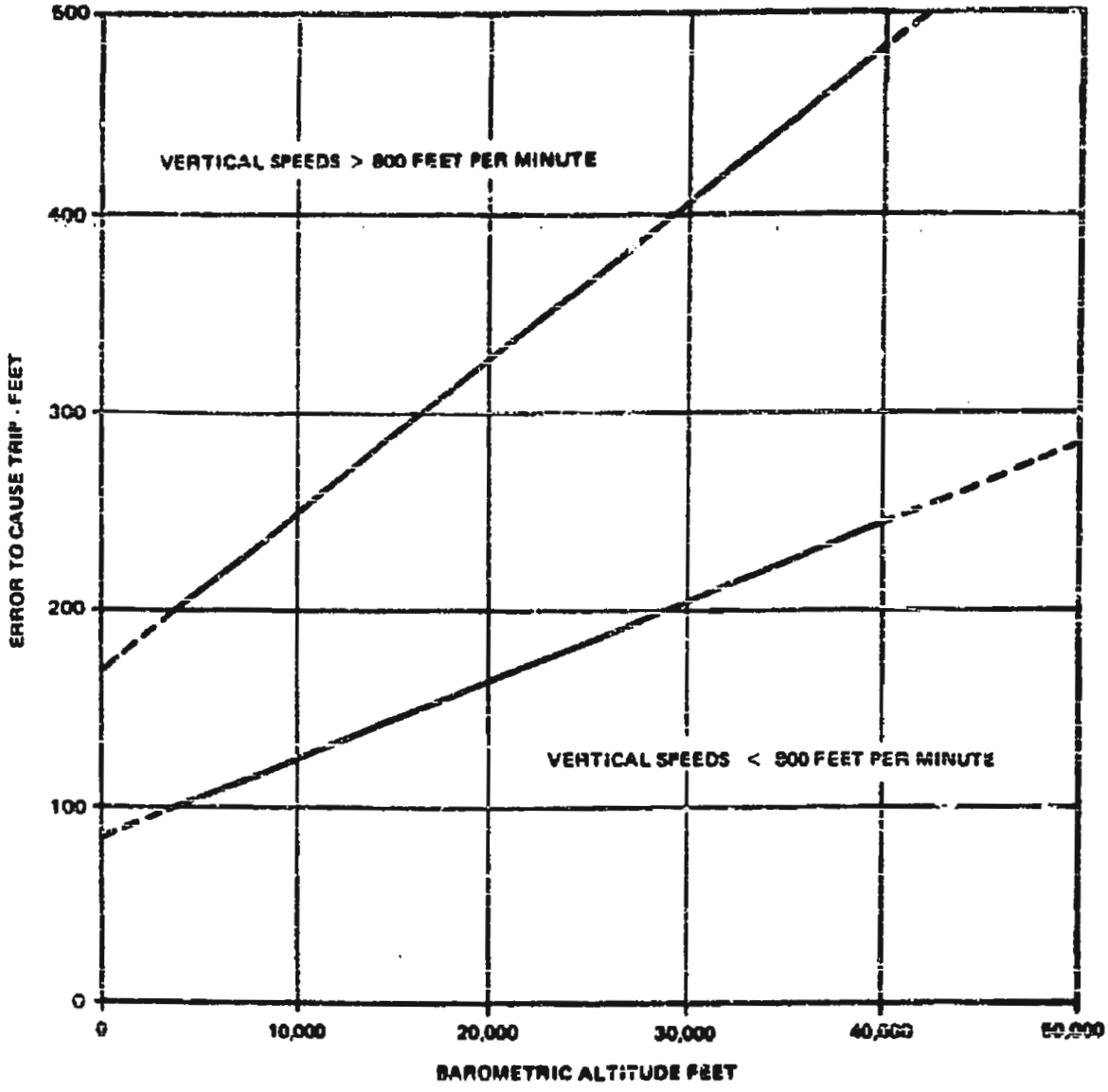
If the TEST 1 pushbutton switch on the Captains or First Officers INSTR COMPARATOR indicator is pressed, a high signal is fed to the self-test bias circuit. This action simulates an error as seen by the error monitor, the resulting output is delayed for 2 seconds by the time delay, and amplified by the comparison driver, driving the INSTR COMPARATOR indicators to annunciate ALTITUDE (yellow).

If the TEST 2 pushbutton switch on the Captains or First Officers INSTR COMPARATOR indicator is pressed, a low signal from the intentionally failed power supply is gated through and inverted by the excitation and power supply monitor gate to turn on the monitor warning driver. The resulting output drives both INSTR COMPARATOR indicators to display all annunciations cross-hatched yellow.

(3) Airspeed Comparison Monitor Channel

The airspeed comparison monitor channel monitors airspeed error information from the First Officers airspeed Mach indicator (servoed) (Ref. Fig. 3).

The Captains airspeed bootstrap transolver transmits three-wire airspeed information to the First Officers airspeed bootstrap transolver. The First Officers airspeed bootstrap transolver combines mechanical angle with the three-wire electrical angle to provide
R airspeed comparison of ADC No. 1 and ADC No. 2 airspeed outputs. This null or error information from the First Officers airspeed Mach indicator (servoed) is fed through the self-test bias circuit to the error monitor. The error monitor threshold is adjusted by a two-wire airspeed signal from air data computer No. 2, which is processed and converted to a varying dc signal by the AC/DC circuit as a function of airspeed. The varying dc output is applied to the threshold modifier which varies the threshold level with airspeed. The nominal airspeed difference required to cause a fault indication increases linearly from 24.7 knots at 30 knots of airspeed to 6 knots at 110 knots of airspeed. At airspeeds of 110 knots to 200 knots, the nominal airspeed difference required to cause a fault



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R
R Altitude Threshold Modification Chart
Figure 4

indication remains constant at 6 knots. At an airspeed of 200 knots to 450 knots, the nominal airspeed difference for a fault indication increases linearly from 6 knots at 200 knots of airspeed, to 10 knots at 450 knots of airspeed (Ref. Fig. 5).

If the comparison monitor channel does not detect a comparison error or failure, the INSTR COMPARATOR indicators will indicate blank (black).

If a comparison error is detected by the comparison monitor, a high (28V dc) output signal is delayed for 2 seconds by the time delay and then applied to the comparison driver. The amplified output drives the INSTR COMPARATOR indicators to annunciate AIRSPEED (yellow).

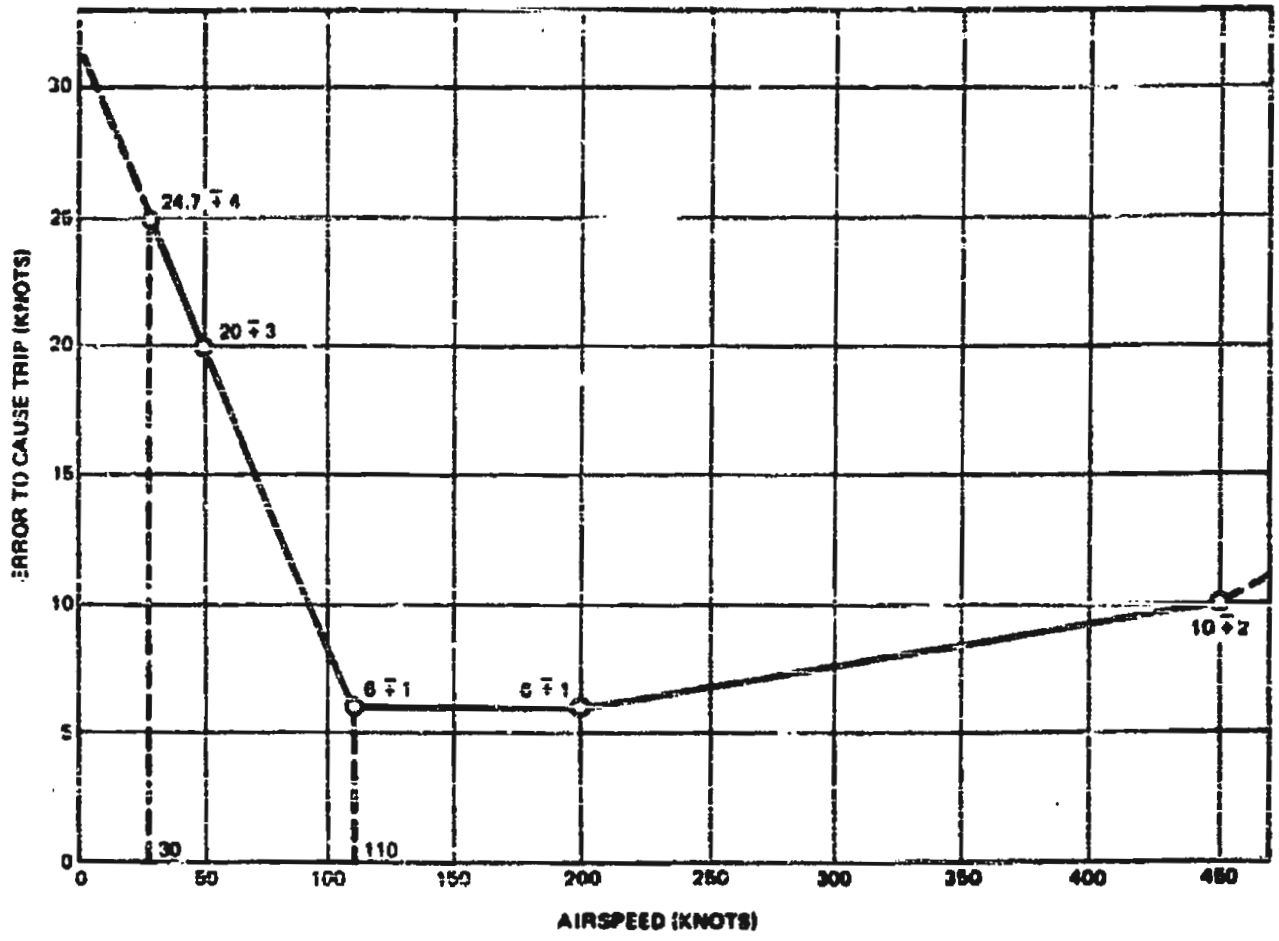
If the airspeed transolver excitation signal drops from high to low, the level detector applies this low signal to the excitation and power supply monitor gate. This signal is gated through and inverted to turn on the monitor warning driver which drives the INSTR COMPARATOR indicators to annunciate AS MON (cross-hatched yellow).

If the TEST 1 pushbutton switch on the Captains or First Officers INSTR COMPARATOR indicator is pressed, a high signal is fed to the self-test bias circuit. This action simulates an error as seen by the error monitor, the resulting output is delayed for 2 seconds by the time delay, and amplified by the comparison driver to drive the INSTR COMPARATOR indicators to annunciate AIRSPEED (yellow).

If the TEST 2 pushbutton switch on the Captains or First Officers INSTR COMPARATOR indicator is pressed, a low signal from the intentionally failed power supply is gated through and inverted by the excitation and power supply monitor to turn on the monitor warning driver. The resulting output drives both INSTR COMPARATOR indicators to display all annunciations cross-hatched yellow.

(4) Heading Comparison Monitor Channel

This channel monitors heading information from the First Officers horizontal situation indicator (HSI) (Ref. Fig. No. 3). The Captains heading bootstrap transolver transmits three-wire heading information to the First Officers heading bootstrap transolver. The First Officers heading bootstrap transolver combines mechanical angle with the three-wire electrical angle



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R Airspeed Threshold Modification Chart
R Figure 5

to provide heading comparison of magnetic heading reference system (MHRS) No. 1 and MHRS No. 2 heading outputs. This null or error information from the First Officers HSI is fed through the self test bias circuit to the error monitor. The error monitor threshold is
R adjusted by a two-wire roll signal from attitude
R reference system No. 3 which is demodulated and applied to the threshold modifier. The dc output raises the dc threshold as the roll signal increases, therefore raising the threshold level. This channel monitors signals for roll attitude not exceeding ±30 degrees. The nominal heading difference required to cause a fault indication increases linearly from 6 degrees at zero degree roll attitude to 15 degrees at 30 degrees roll attitude. A roll signal from the vertical gyro is used to widen the trip point during turns (Ref. Fig. 6).

If the comparison monitor channel does not detect a comparison error or failure, the INSTR COMPARATOR indicators will indicate blank (black).

If a comparison error is detected by the comparison monitor the high (28V dc) output is delayed for two seconds by the time delay and then applied to the comparison driver. The amplified output drives the INSTR COMPARATOR indicators to annunciate HEADING (yellow).

If the heading transolver excitation signal drops from high to low, the level detector applies this low signal to the excitation and power supply monitor gate. This signal is gated through and inverted to turn on the monitor warning driver. The resulting output drives the INSTR COMPARATOR indicators to annunciate HDG MON (cross-hatched yellow).

If the TEST 1 pushbutton switch on the Captains and First Officers INSTR COMPARATOR indicator is pressed, a high signal is fed to the self test bias circuit. This action simulates an error as seen by the error monitor, the resulting output is delayed for two seconds by the time delay, and amplified by the comparison driver to drive the INSTR COMPARATOR indicators to annunciate HEADING (yellow).

If the TEST 2 pushbutton on the Captains and First Officers INSTR COMPARATOR indicator is pressed, a low signal from the intentionally failed power supply is inverted and gated through the power fail gate to turn on the monitor warning driver to drive the INSTR

COMPARATOR indicators to display all annunciations cross-hatched yellow.

4. INSTR COMPARATOR Indicator

A. Description

The INSTR COMPARATOR indicators provide visual warnings to alert the Captain and First Officer of comparison errors between altitude, airspeed, attitude, and heading sources; and loss of comparison transolver excitations and instrument comparison monitor power supply failure (Ref. Fig. 7). Each INSTR COMPARATOR indicator contains four prismatic electromechanical annunciators and two test switches (Ref. Fig. 1 and Fig. 7). Each annunciator contains solenoid coils which actuate a three-sided block. Two sides of the block display a message inscribed on a yellow or cross-hatched yellow background. The third side of the block is blank (black).

B. Operation

The annunciator solenoid coils are actuated by 28V dc output drive signals from four comparison monitor channels in the comparison monitor. Instrument lighting is provided from the nearest associated dimming device (Ref. 33-10-00).

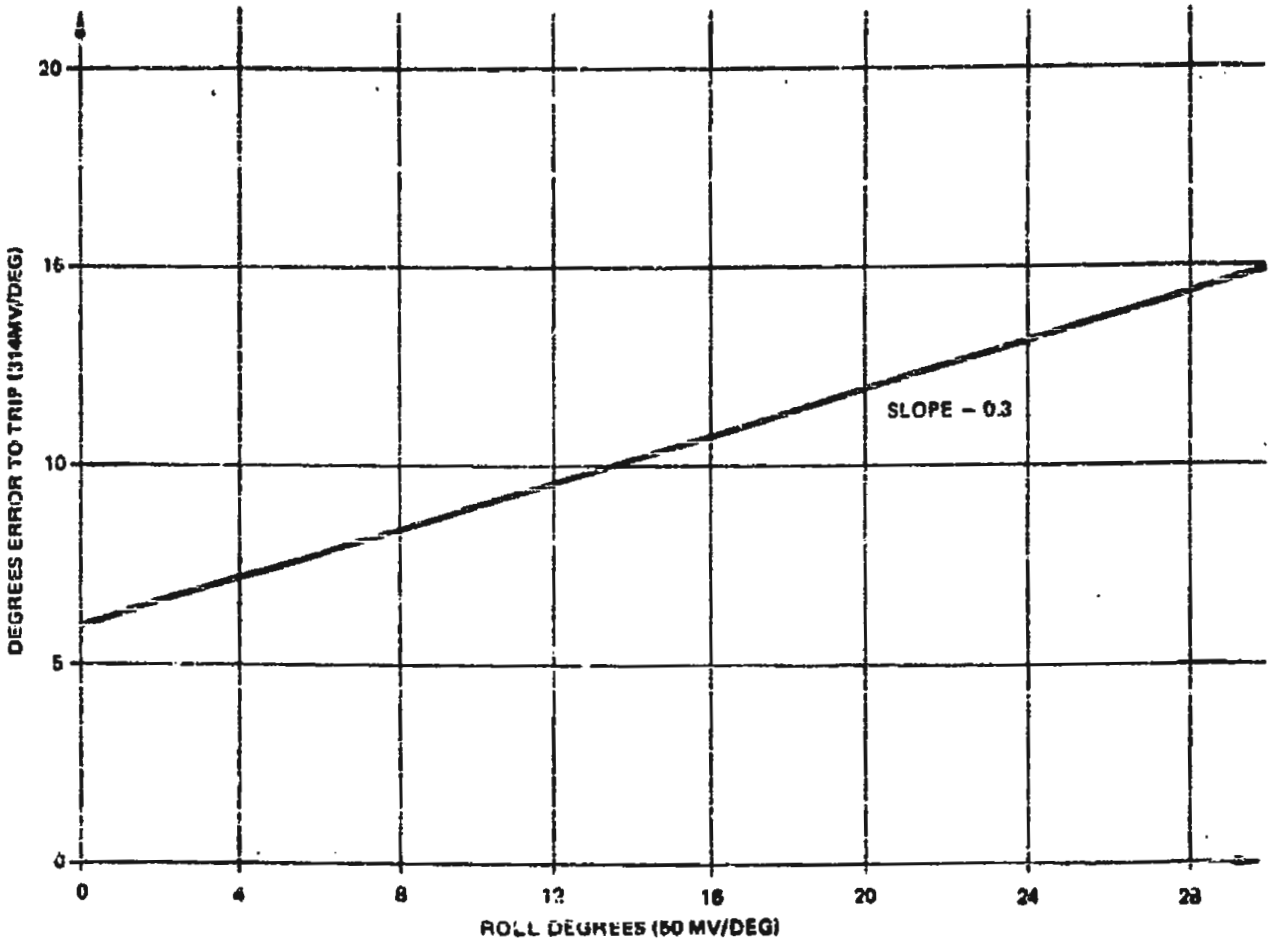
(1) Prismatic Electromechanical Annunciators

If a comparison monitor channel detects a comparison error, a 28V dc comparison fail drive signal energizes the corresponding annunciator coil which drives the three-sided block to display AIRSPEED, ATTITUDE, ALTITUDE, or HEADING on a yellow background.

If a comparison monitor channel detects an excitation or power failure, a 28V dc monitor fail drive signal energizes the corresponding annunciator coil which drives the three-sided block to display AS MON, ATT MON, ALT MON, or HDG MON, as applicable, on a cross-hatched yellow background. Due to a common power supply, all annunciations will display with a power failure.

(2) Self-Test

When either TEST 1 pushbutton is pressed, 28V dc is switched through the TEST 1 switch to the comparison monitor circuits in each of the four comparison monitor channels. The outputs from the four channels energize



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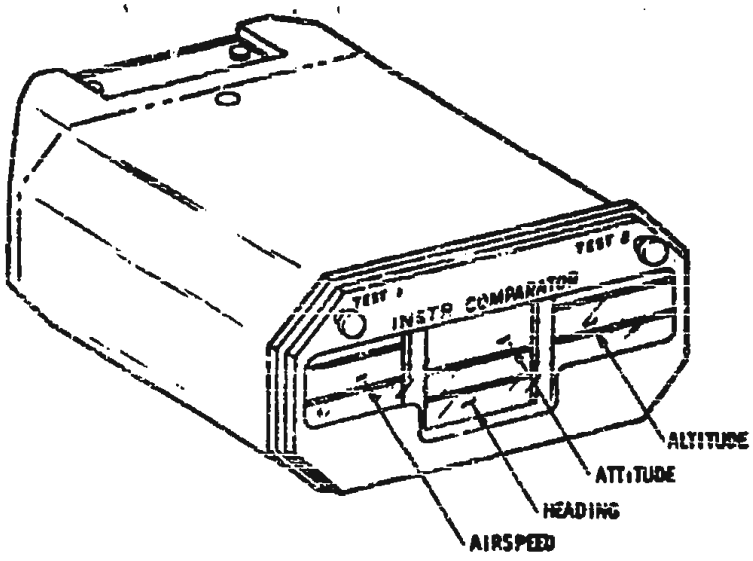
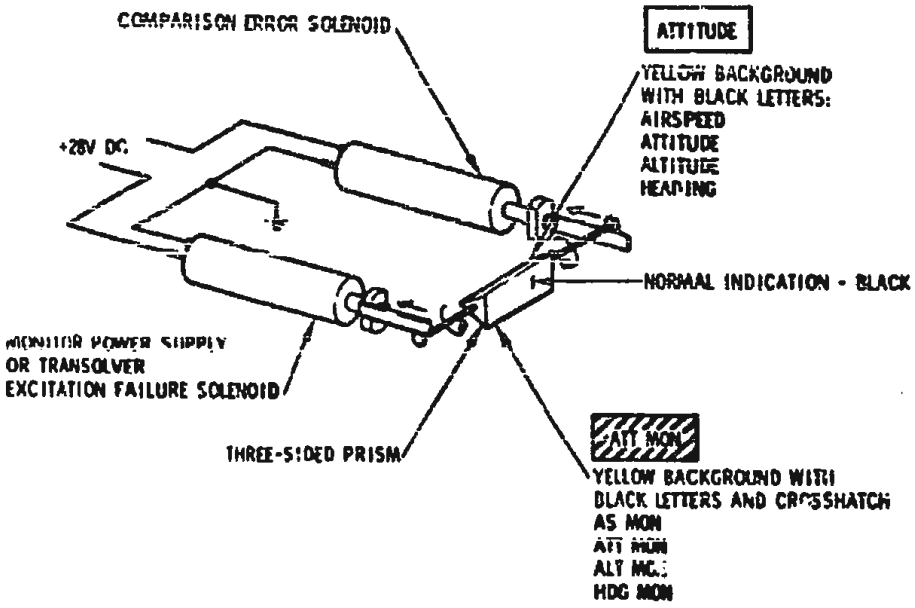
Heading Threshold Modification Chart
Figure 6





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R Instrument Comparator Indicator (4 Message)
R Figure 7

R EFFECTIVITY: ALL

corresponding annunciator coils to display AIRSPEED, ATTITUDE, ALTITUDE, and HEADING on a yellow background

Pressing the Captains TEST 1 simulates comparison errors in all channels simultaneously. In the attitude channel this simulates an error between ARS No. 1 and ARS No. 3. Pressing the First Officers TEST 1 is identical except in the attitude channel the error is between ARS No. 2 and ARS No. 3.

When both Captains and First Officers TEST 1 pushbuttons are pressed simultaneously, 28V dc is switched through both TEST 1 switches to the comparison monitor circuits in all comparison monitor channels. The outputs from all channels, except attitude, will energize corresponding annunciator coils to drive the three-sided blocks to display yellow background messages. In addition, the VERTICAL GYRO 3 light on the caution and warning assembly, center instrument panel will illuminate. This test simulates a failure of Attitude Reference System No. 3.

When the TEST 2 pushbutton is pressed, a low signal (ground) is sent to the power fail logic circuit in the comparison monitor power supply. This causes the four comparison monitor power fail circuits to provide an external 28V dc (aircraft supply) voltage to energize corresponding annunciator coils which drive the three-sided blocks to display AS MON, ATT MON, ALT MON, and HDG MON on a cross-hatched yellow background.

R # CENTRAL INSTRUMENT WARNING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for
R fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at the top of each fault isolation diagram
R must be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on using fault code diagram or
R schematic.

R If the flight crew reports a trouble using a fault code, the
R code can be found in 34 Fault Code Index. The index specifies
R maintenance manual section, fault isolation diagram, and block
R number on diagram where fault isolation procedure should start.
R Schematics are included at end of section to supplement fault
R diagrams or as aid in isolating a problem not covered on
R diagrams.

R Refer to Maintenance Manual Introduction for a more detailed
R discussion of Fault Isolation Reporting Method (FIRM) and use of
R fault isolation diagrams/schematics.

R Since no fault isolation reporting system can cover every
R failure symptom, system functional schematics are provided
R giving information for intercomponent signal tracing from source
R to termination.

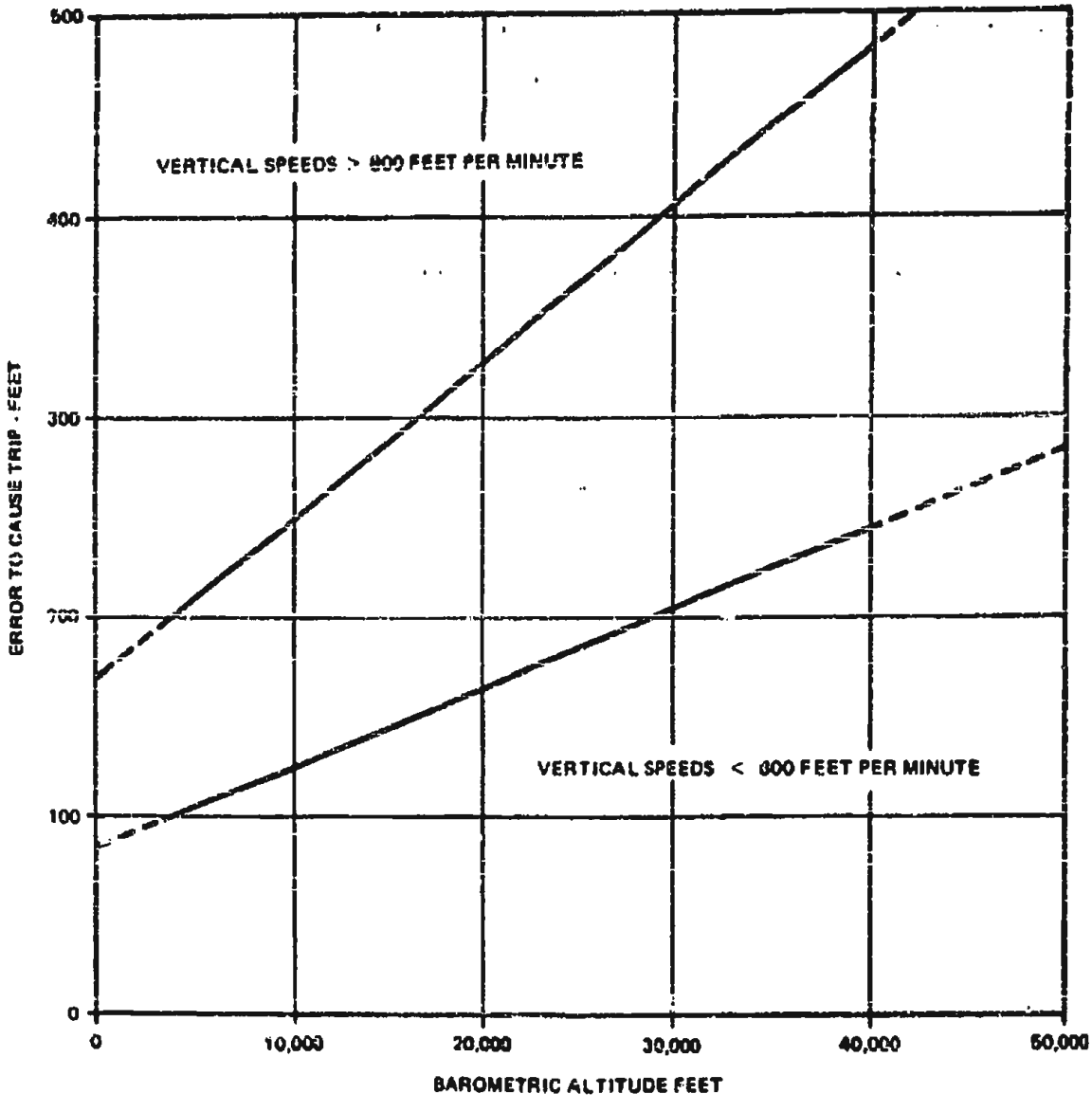
R To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
R Cross Reference (WM DIA CROSS REF) table on system functional
R schematics, listing applicable wiring diagram in L-1011 Wiring
R Diagram Manual.

R 2. Supplemental Fault Isolation Data

R Inertial units (Ref. 34-43-00) or vertical gyros may be
R installed.

R The schematics and fault isolation procedures for the attitude
R channel reflect both configurations.

R To aid in fault isolation, refer to altitude, airspeed, and
R heading threshold level charts, Figures 101, 102, and 103



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R
R

Altitude Threshold
Figure 101

EFFECTIVITY: ALL

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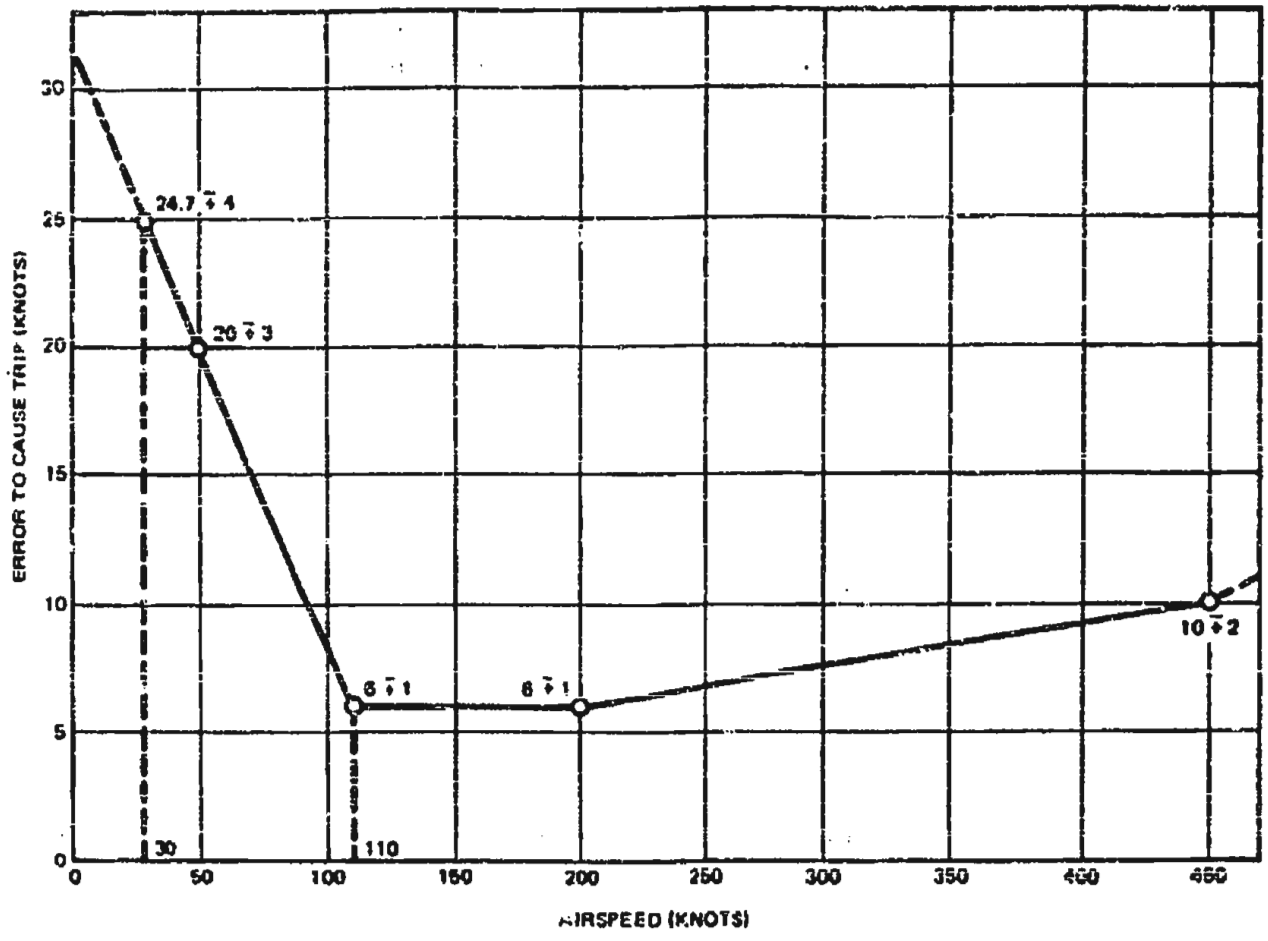

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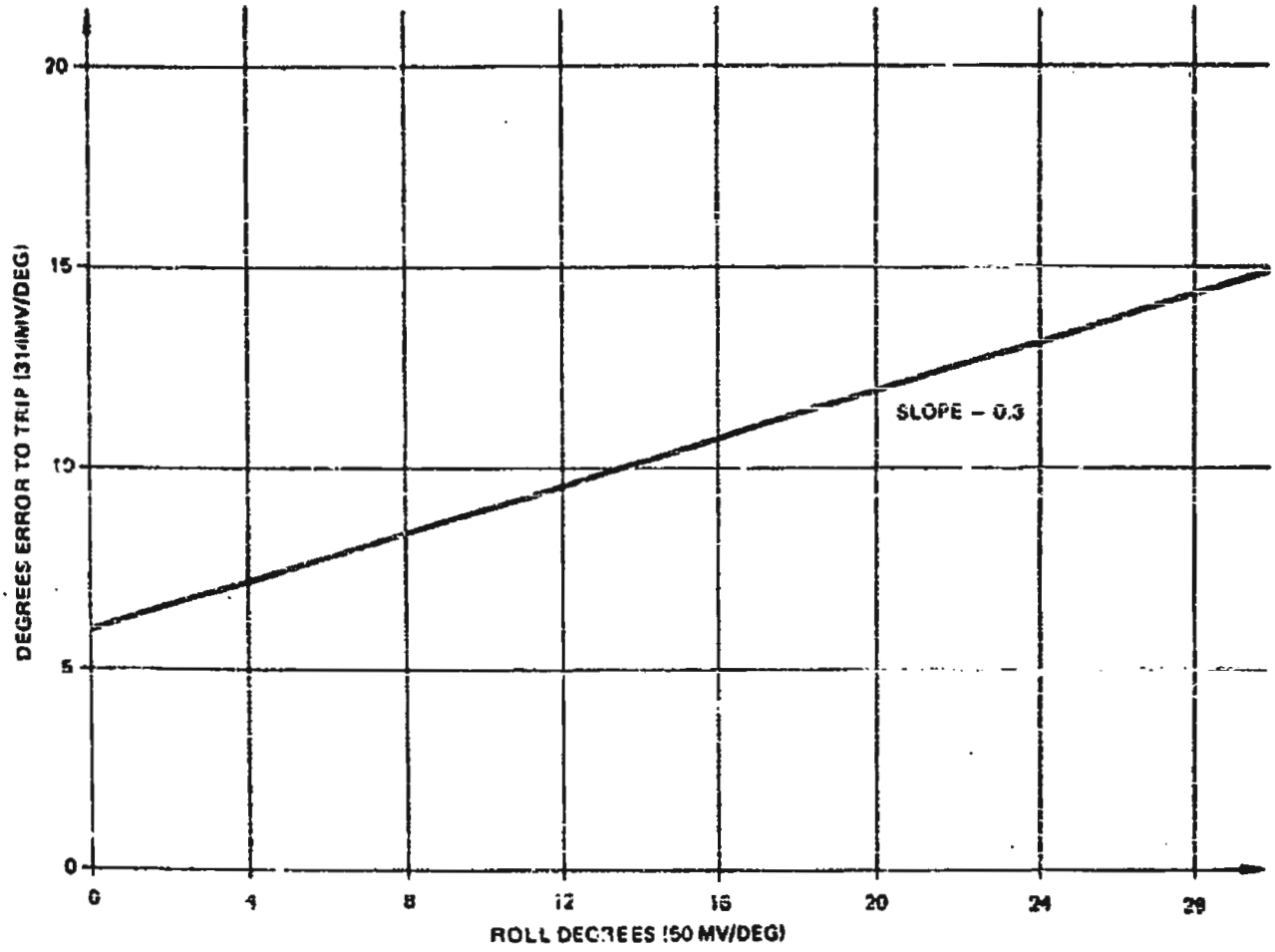
R
R

Airspeed Threshold
Figure 102

EFFECTIVITY: ALL

001B



EM1-18000-34-1681

Heading Threshold
Figure 103

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 104 and 105 provide Central Instrument Warning System locations.

Fault Isolation Diagrams and Schematics List
Table 101

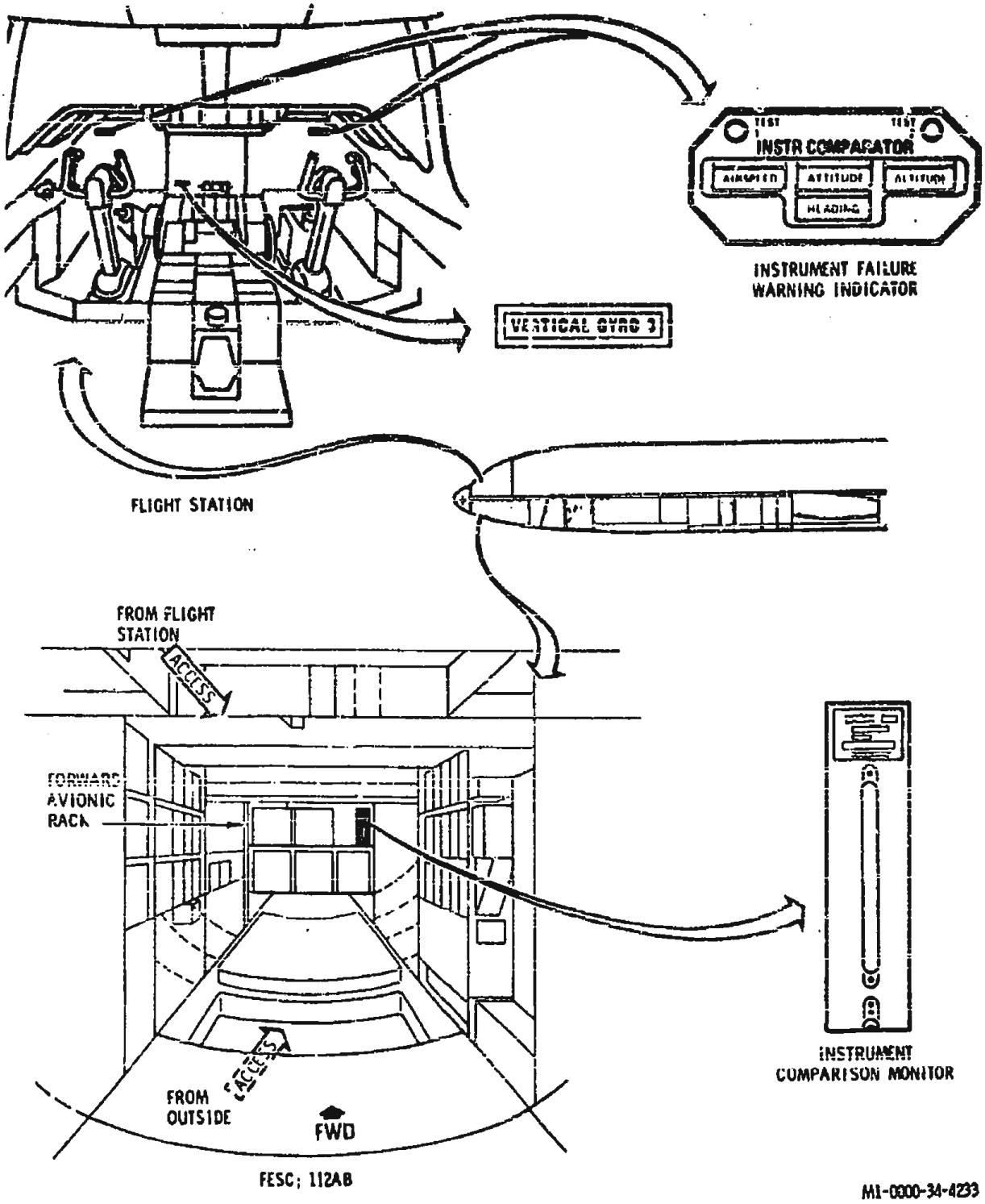
FAULT	TITLE
104	Component Location Index
105	Component Locator Diagram
106	ALTITUDE Message Problems
107	ALT MON Message Problems
108	AIRSPEED Message Problems
109	AS MON Message Problems
110	ADI ATTITUDE Flag Problems
111	ATTITUDE Message Problems
112	VERTICAL GYRO 3 Light Problems
113	ATT MON Message Problems
114	HEADING Message Problems
115	HDG MON Message Problems
116	ALL MON Message Problems
117	TEST 1 or 2 Problems
SCHEM 1	ICM Schematic (Altitude)
SCHEM 2	ICM Schematic (Airspeed)
SCHEM 3	ICM Schematic (Attitude)
SCHEM 4	ICM Schematic (Heading)
SCHEM 5	ICM Power Supply Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
INDICATOR – INSTRUMENT FAILURE WARNING	2	FLT STA; CAPT AND F/O INSTR PNL	34-16-02
MONITOR – INSTRUMENT COMPARISON	1	FESC; FWD RACK; 112AB	34-16-01

M1-0000-34-3308

R
R Component Location Index
Figure 104

R EFFECTIVITY: ALL
R
0018



R
R

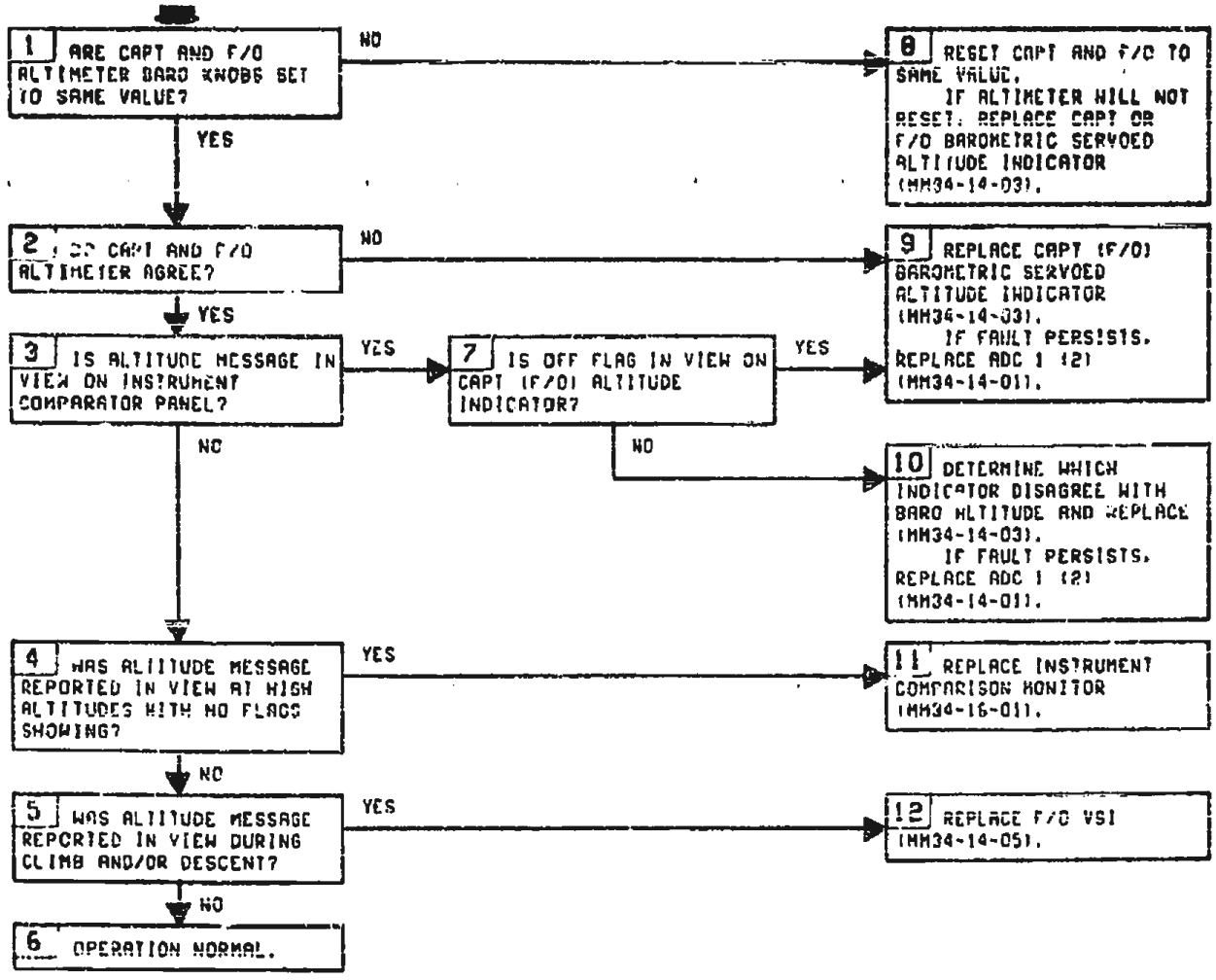
Component Locator Diagram
Figure 105

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MID LO FLO LIGHTS ON FE/EO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D26, 1E1, 1E2, 1F4, 1F22, 168, 1B87, 2B21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED

ALTITUDE MESSAGE PROBLEMS


1 ARE CAPT AND F/O ALTIMETER BARO KNOBS SET TO SAME VALUE?
NO
8 RESET CAPT AND F/O TO SAME VALUE. IF ALTIMETER WILL NOT RESET, REPLACE CAPT OR F/O BAROMETRIC SERVOED ALTITUDE INDICATOR (MM34-14-03).
YES
2 DO CAPT AND F/O ALTIMETER AGREE?
NO
9 REPLACE CAPT (F/O) BAROMETRIC SERVOED ALTITUDE INDICATOR (MM34-14-03). IF FAULT PERSISTS, REPLACE ADC 1 (2) (MM34-14-01).
YES
3 IS ALTITUDE MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANEL?
YES
7 IS OFF FLAG IN VIEW ON CAPT (F/O) ALTITUDE INDICATOR?
YES
NO
10 DETERMINE WHICH INDICATOR DISAGREE WITH BARO ALTITUDE AND REPLACE (MM34-14-03). IF FAULT PERSISTS, REPLACE ADC 1 (2) (MM34-14-01).
NO
4 WAS ALTITUDE MESSAGE REPORTED IN VIEW AT HIGH ALTITUDES WITH NO FLAGS SHOWING?
YES
11 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
NO
5 WAS ALTITUDE MESSAGE REPORTED IN VIEW DURING CLIMB AND/OR DESCENT?
YES
12 REPLACE F/O VSI (MM34-14-05).
NO
6 OPERATION NORMAL.

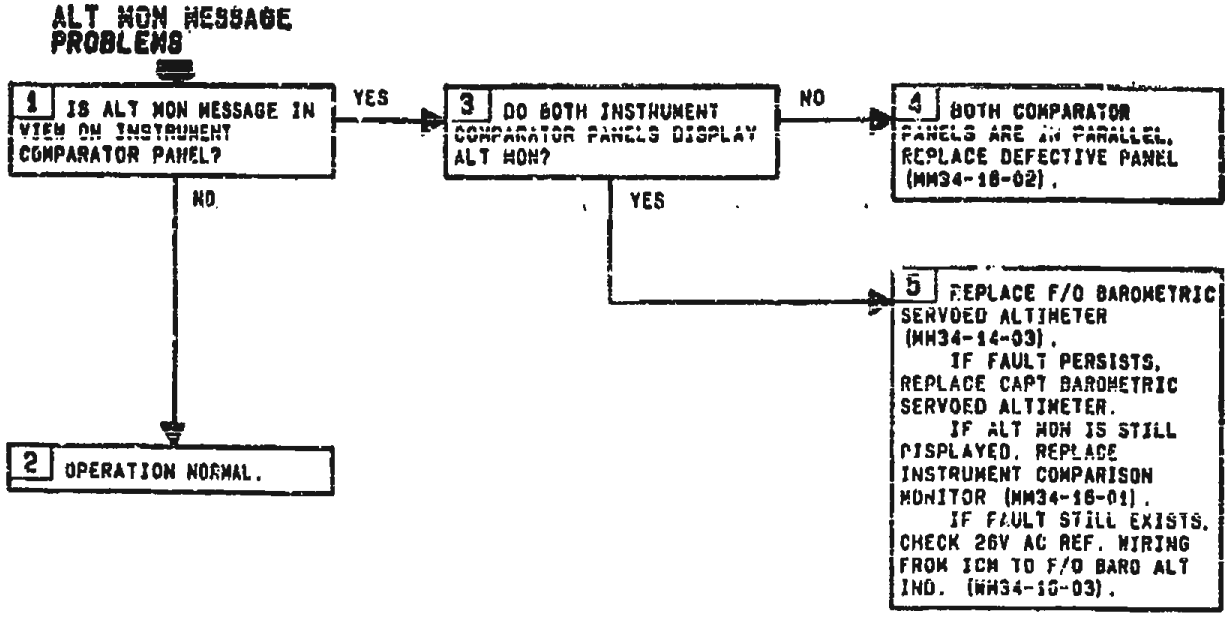
M1-0007-34-1338

R ALTITUDE Message Problems
R Figure 106

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MIC LO FLO LIGHTS ON P2/80 ECS MONITOR PANEL ARE OUT
CB'S: 1D9, 1D26, 1E1, 1E2, 1F1, 1F18, 188, 1827, 2A21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED


ALT MON MESSAGE PROBLEMS
1 IS ALT MON MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANEL?
YES
3 DO BOTH INSTRUMENT COMPARATOR PANELS DISPLAY ALT MON?
NO
4 BOTH COMPARATOR PANELS ARE IN PARALLEL. REPLACE DEFECTIVE PANEL (MM34-16-02).
NO
2 OPERATION NORMAL.
YES
5 REPLACE F/O BAROMETRIC SERVOED ALTIMETER (MM34-14-03).
IF FAULT PERSISTS, REPLACE CAPT BAROMETRIC SERVOED ALTIMETER.
IF ALT MON IS STILL DISPLAYED, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
IF FAULT STILL EXISTS, CHECK 26V AC REF. WIRING FROM ICM TO F/O BARO ALT IND. (MM34-16-03).

M1-0007-34-1940

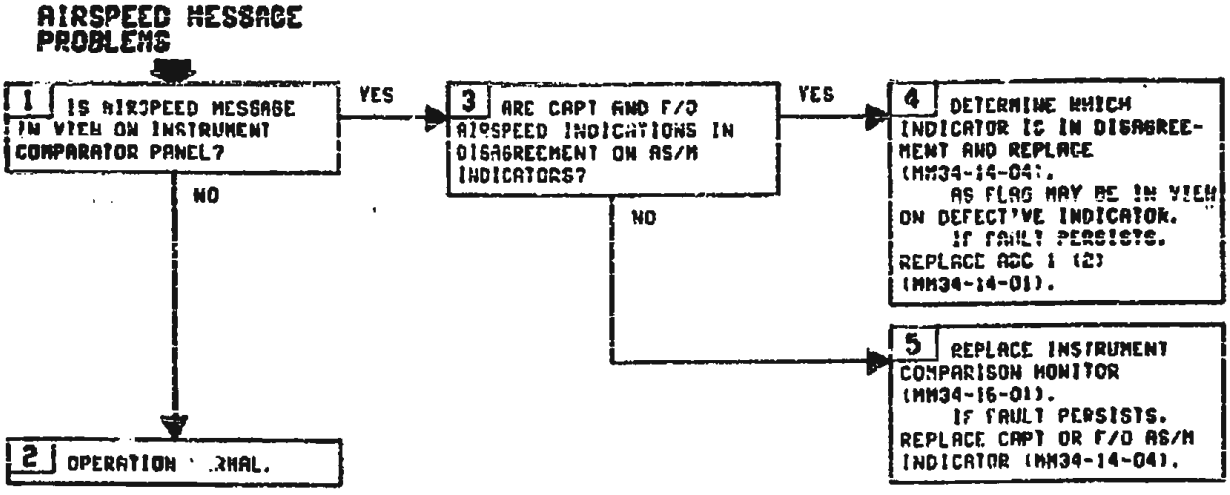
R
R

ALT MON Message Problems
Figure 107

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MID LO FLO LIGHTS ON FE/SD ECS MONITOR PANEL ARE OUT
CB'S: 109, 1026, 1E1, 1E2, 1F1, 1F19, 169, 1627, 2R2E
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED


AIRSPEED MESSAGE PROBLEMS
1 IS AIRSPEED MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANEL?
YES
NO
3 ARE CAPT AND F/O AIRSPEED INDICATIONS IN DISAGREEMENT ON AS/M INDICATORS?
YES
NO
4 DETERMINE WHICH INDICATOR IS IN DISAGREEMENT AND REPLACE (MM34-14-04).
AS FLAG MAY BE IN VIEW ON DEFECTIVE INDICATOR.
IF FAULT PERSISTS, REPLACE ADC 1 (2) (MM34-14-01).
5 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
IF FAULT PERSISTS, REPLACE CAPT OR F/O AS/M INDICATOR (MM34-14-04).
2 OPERATION NORMAL.

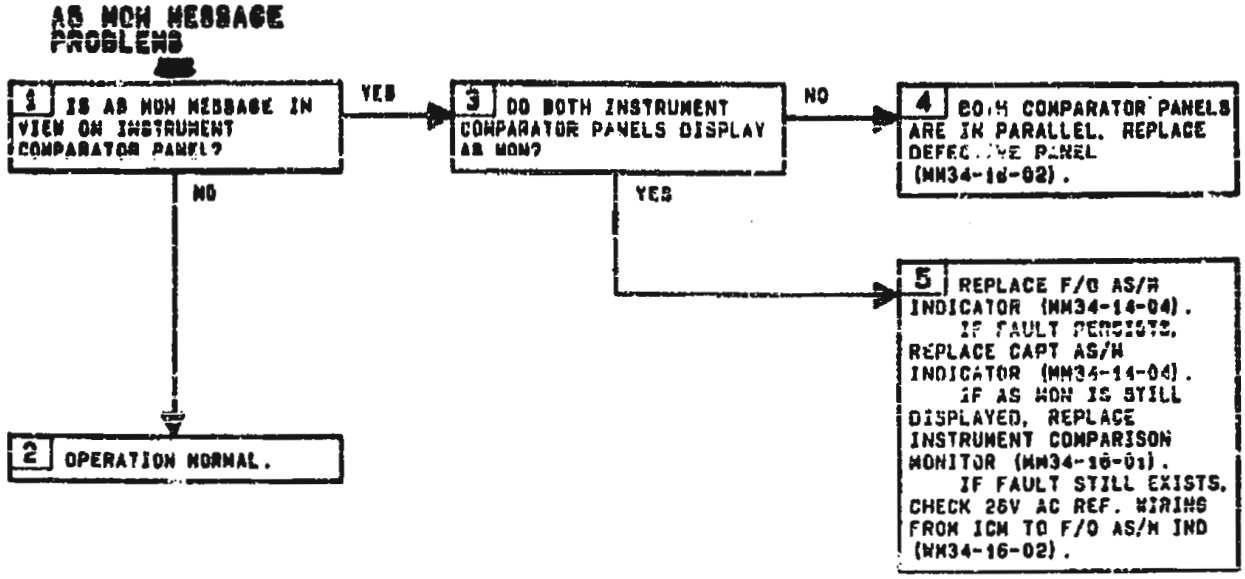
M1-0008-34-1341

R AIRSPEED Message Problems
R Figure 108

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MID LO FLO LIGHTS ON 7E/8D
ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D23, 1E1, 1E2, 1F1, 1F16, 1B9, 1B27, CA21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED


AS MON MESSAGE PROBLEMS
1 IS AS MON MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANEL?
YES
3 DO BOTH INSTRUMENT COMPARATOR PANELS DISPLAY AS MON?
NO
4 BOTH COMPARATOR PANELS ARE IN PARALLEL. REPLACE DEFECTIVE PANEL (MM34-16-02).
NO
YES
2 OPERATION NORMAL.
5 REPLACE F/O AS/M INDICATOR (MM34-14-04).
IF FAULT PERSISTS, REPLACE CAPT AS/M INDICATOR (MM34-14-04).
IF AS MON IS STILL DISPLAYED, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
IF FAULT STILL EXISTS, CHECK 26V AC REF. WIRING FROM ICM TO F/O AS/M IND (MM34-16-02).

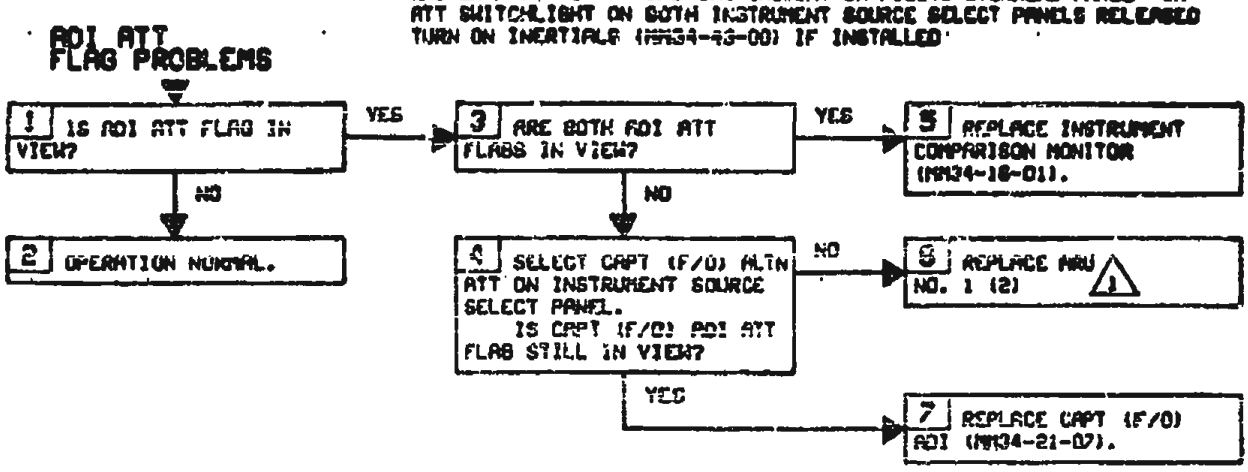
M1-0007-34-1342

R AS MON Message Problems
R Figure 109

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MID. AND *INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D28, 1C1, 1C2, *1E6, *1E7, 1C19, 1E24, *1E25, 1F8, 1F20, 1B6, 1B24, *1B25, BR21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ATT SWITCHLIGHT ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
TURN ON INERTIALS (MM34-43-00) IF INSTALLED


ADI ATT FLAG PROBLEMS
1 IS ADI ATT FLAG IN VIEW?
YES
NO
2 OPERATION NORMAL.
3 ARE BOTH ADI ATT FLAGS IN VIEW?
YES
NO
5 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
4 SELECT CAPT (F/O) ALTN ATT ON INSTRUMENT SOURCE SELECT PANEL.
IS CAPT (F/O) ADI ATT FLAG STILL IN VIEW?
NO
6 REPLACE ARU NO. 1 (2) 1
YES
7 REPLACE CAPT (F/O) ADI (MM34-21-07).

NOTE

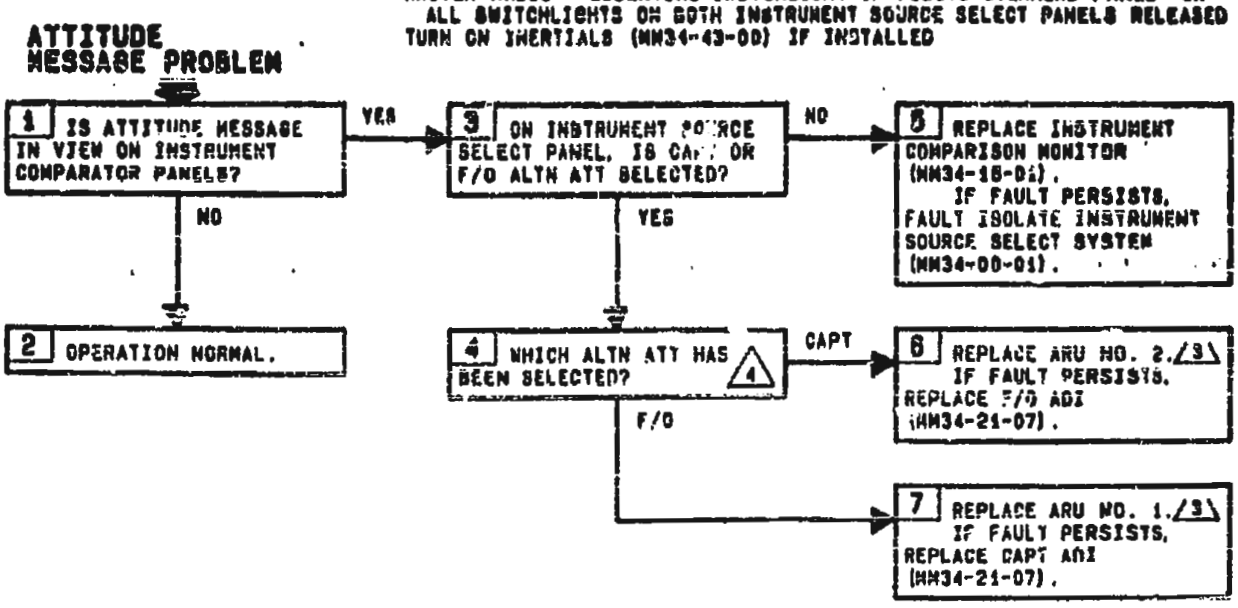
1 ARU - ATTITUDE REFERENCE UNIT
INERTIAL UNIT (MM34-43-03) OR VG (MM34-21-04)

* AIRCRAFT WITH INERTIALS INSTALLED

KS-8000-34-3827

R ADI Attitude Flag Problems
R Figure 110

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND AIME COOLING LO FLO LIGHT ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D28, 1E1, 1E2, #1E6, #1E7, 1E19, 1E24, 1F2, 1F26, 1B8, 1B24, #1B25, 2AB1
MASTER RADIO - ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
TURN ON INERTIALS (MM34-43-00) IF INSTALLED


ATTITUDE MESSAGE PROBLEM
1 IS ATTITUDE MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANELS?
YES
NO
2 OPERATION NORMAL.
3 ON INSTRUMENT SOURCE SELECT PANEL, IS CAPT OR F/O ALTN ATT SELECTED?
NO
YES
5 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-04). IF FAULT PERSISTS, FAULT ISOLATE INSTRUMENT SOURCE SELECT SYSTEM (MM34-00-01).
4 WHICH ALTN ATT HAS BEEN SELECTED? 4
CAPT
F/O
6 REPLACE ARU NO. 2./3\ IF FAULT PERSISTS, REPLACE F/O ADI (MM34-21-07).
7 REPLACE ARU NO. 1./3\ IF FAULT PERSISTS, REPLACE CAPT ADI (MM34-21-07).

NOTE

1 ASSUMING THAT THE INSTRUMENT COMPARISON MONITOR IS GOOD, THE ATTITUDE MESSAGES WILL COME INTO VIEW ONLY IF CAPTAIN OR F/O HAS SELECTED ATT ALTN. IN THIS CASE, VG NO. 1 (IU NO. 1) OR VG NO. 2 (IU NO. 2) WILL HAVE FAILED AND A 2 GYRO COMPARISON IS IN EFFECT.

2 IU = INERTIAL UNIT

3 ARU = ATTITUDE REFERENCE UNIT INERTIAL UNIT (MM34-43-03) OR VG (MM34-21-04).

4 DE-SELECTION OF ALTN ATT FOR THIS FAULT COULD RESULT IN A VERTICAL GYRO 3 WARNING LIGHT AND VG-2 WOULD BE THE FAULTY UNIT.

AIRCRAFT WITH INS INSTALLED

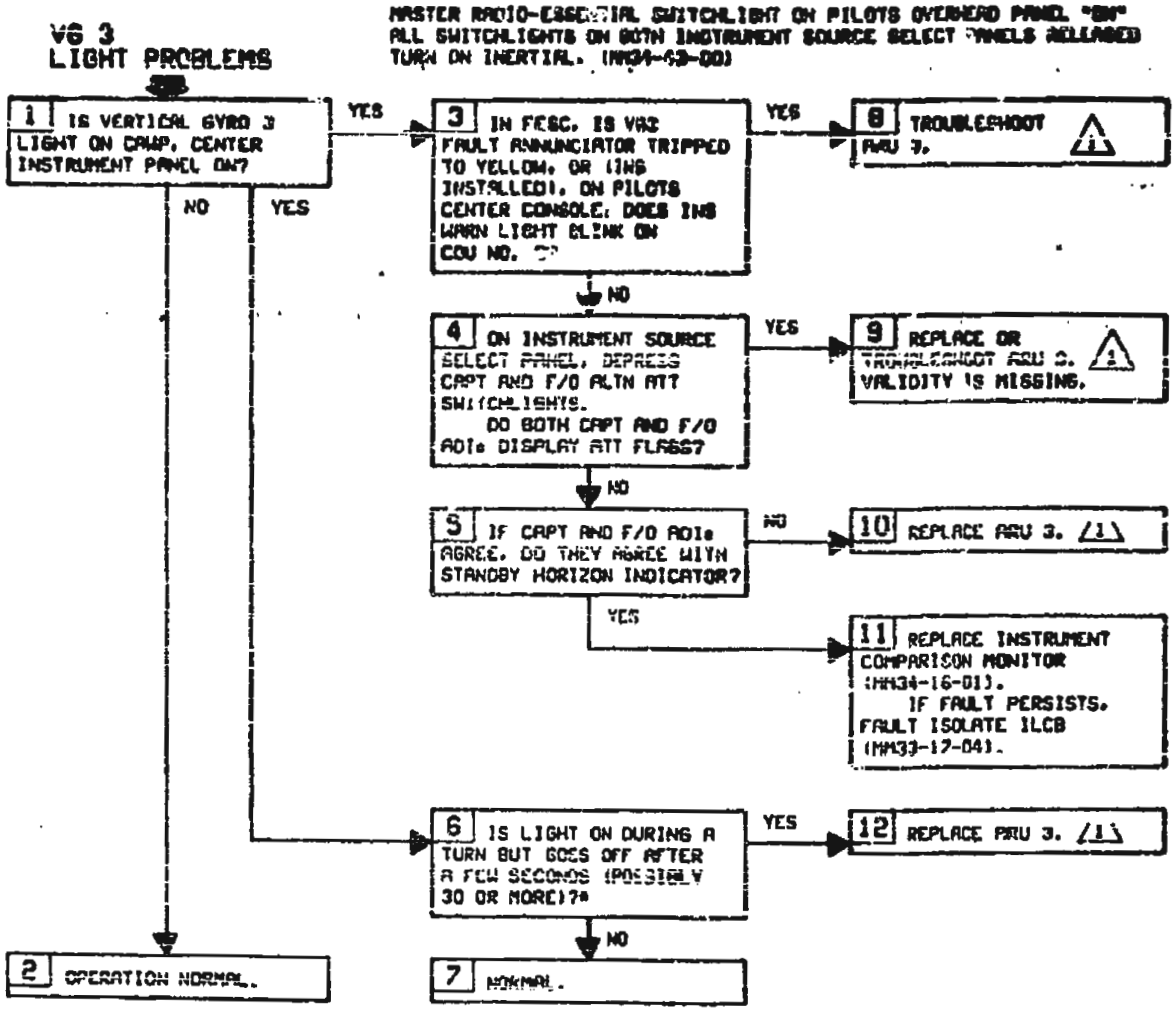
M1-0900-34-1407

R ATTITUDE Message Problems
R Figure 111

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD. MID. AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D26, 3E1, 1E2, **1E6, **1E7, 1E19, 1E24, 1E25, 1F2, 1F6, 1F7, 1F20, 1B6, 1B24, **1B25, 2R21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
TURN ON INERTIAL. (MM34-43-00)


V6 3
LIGHT PROBLEMS
1 IS VERTICAL GYRO 3 LIGHT ON CAMP, CENTER INSTRUMENT PANEL ON?
YES
NO
YES
3 IN FESC, IS VR3 FAULT ANNUNCIATOR TRIPPED TO YELLOW, OR (INS INSTALLED), ON PILOTS CENTER CONSOLE, DOES INS WARN LIGHT BLINK ON CDU NO. 3?
YES
8 TROUBLESHOOT ARU 3. /1\
NO
4 ON INSTRUMENT SOURCE SELECT PANEL, DEPRESS CAPT AND F/O ALTN ATT SWITCHLIGHTS. DO BOTH CAPT AND F/O ADI* DISPLAY ATT FLAGS?
YES
9 REPLACE OR TROUBLESHOOT ARU 3. /1\ VALIDITY IS MISSING.
NO
5 IF CAPT AND F/O ADI* AGREE, DO THEY AGREE WITH STANDBY HORIZON INDICATOR?
NO
10 REPLACE ARU 3. /1\
YES
11 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01). IF FAULT PERSISTS, FAULT ISOLATE ILCB (MM33-17-041).
6 IS LIGHT ON DURING A TURN BUT GOES OFF AFTER A FEW SECONDS (POSSIBLY 30 OR MORE)?*
YES
12 REPLACE ARU 3. /1\
NO
2 OPERATION NORMAL.
7 NORMAL.

NOTE

/1\ ARU = ATTITUDE REFERENCE UNIT
INERTIAL UNIT (MM34-43-03) OR V6 (MM34-21-04)

* THIS PROBLEM WILL TAKE PLACE ONLY IF A V6 IS INSTALLED IN NO. 3 POSITION

** AIRCRAFT WITH INERTIALS INSTALLED

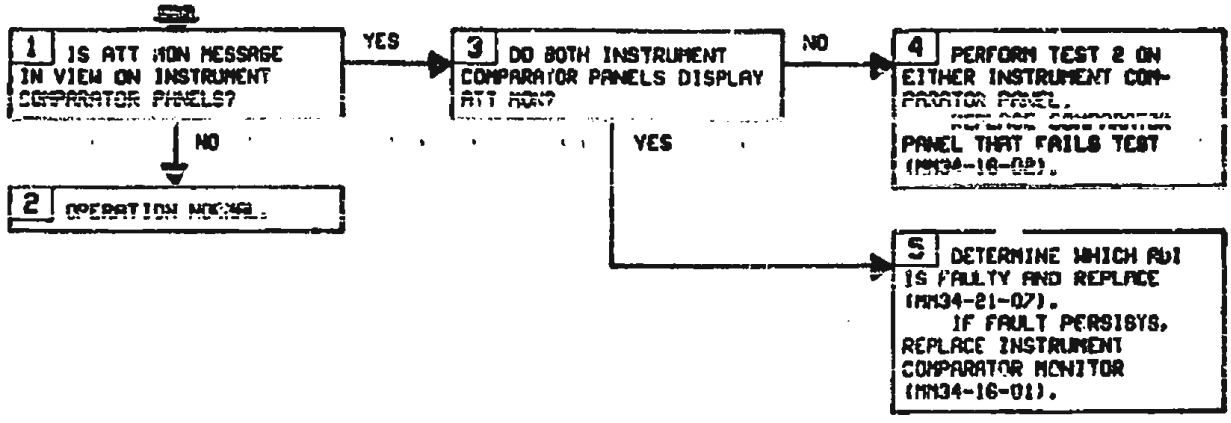
M1-2009-34-1438

R
R VERTICAL Gyro 3 Light Problems
Figure 112

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1DA, 1D2S, 1E1, 1E2, *1E6, *1E7, 1E19, *1E24, *1E25, 1F2, 1F20, 1G6, 1G24, *1G25, 2A21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ATT SWITCHLIGHT ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
TURN ON INERTIALS (MM34-43-00) IF INSTALLED

ATT MON MESSAGE PROBLEMS


1 IS ATT MON MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANELS?
YES
3 DO BOTH INSTRUMENT COMPARATOR PANELS DISPLAY ATT MON?
NO
4 PERFORM TEST 2 ON EITHER INSTRUMENT COMPARATOR PANEL.
PANEL THAT FAILS TEST (MM34-16-02).
NO
2 OPERATION NORMAL.
YES
5 DETERMINE WHICH ADI IS FAULTY AND REPLACE (MM34-21-07).
IF FAULT PERSISTS, REPLACE INSTRUMENT COMPARATOR MONITOR (MM34-16-01).

NOTE

BEFORE STARTING BLOCK 4 OR 5, CHECK CB 1D8 AND 1D2S FOR ENGAGEMENT. IF OK, CYCLE 2 OR 3 TIMES AND CHECK IF FAULT IS CLEARED

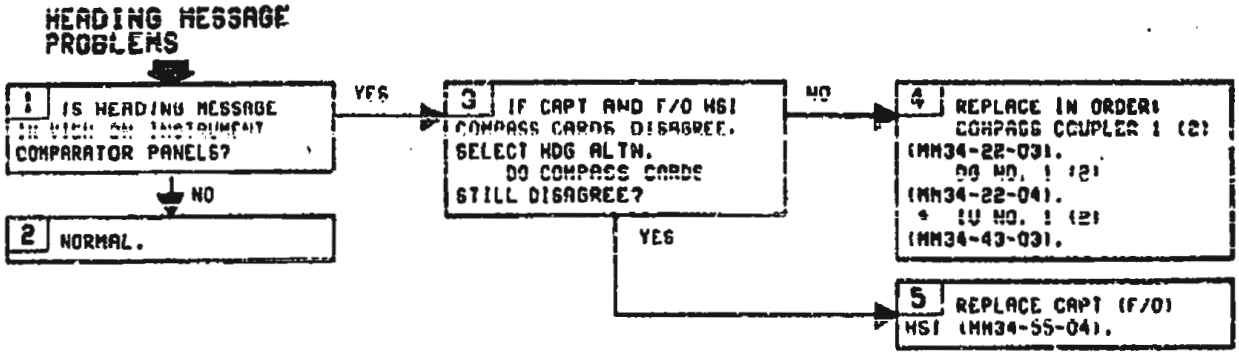
* AIRCRAFT WITH INERTIALS INSTALLED

M1-2000-34-2569

R ATT MON Message Problems
R Figure 113

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND *INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8,1D9,1D26,1D27,1E1,1E2,*1E6,*1E7,*1E24,*1E25, 1F3,1F5,1F21,1G5,1G7,1G23,1G24,*1G25,1G26,1J18, 1K19,1K24,2A21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
HDG SWITCHLIGHT ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
TURN ON INERTIALS (MM34-43-00) IF INSTALLED


HEADING MESSAGE PROBLEMS
1 IS HEADING MESSAGE ON PILOTS INSTRUMENT COMPARATOR PANELS?
YES
NO
2 NORMAL.
3 IF CAPT AND F/O HSI COMPASS CARDS DISAGREE. SELECT HDG ALTN. DO COMPASS CARDS STILL DISAGREE?
NO
YES
4 REPLACE IN ORDER: COMPASS COUPLER 1 (2) (MM34-22-03). DG NO. 1 (2) (MM34-22-04). * IU NO. 1 (2) (MM34-43-03).
5 REPLACE CAPT (F/O) HSI (MM34-55-04).

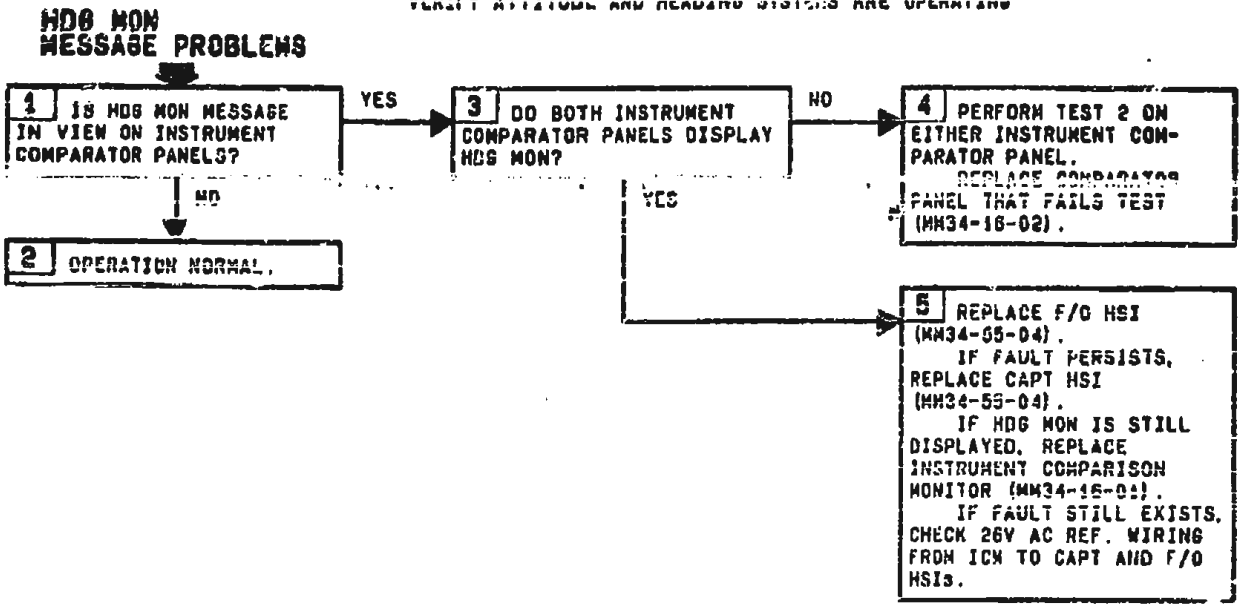
NOTE
IU = INERTIAL UNIT
* AIRCRAFT WITH INS INSTALLED

M1-0001-34-3530

HEADING Message Problems
Figure 114

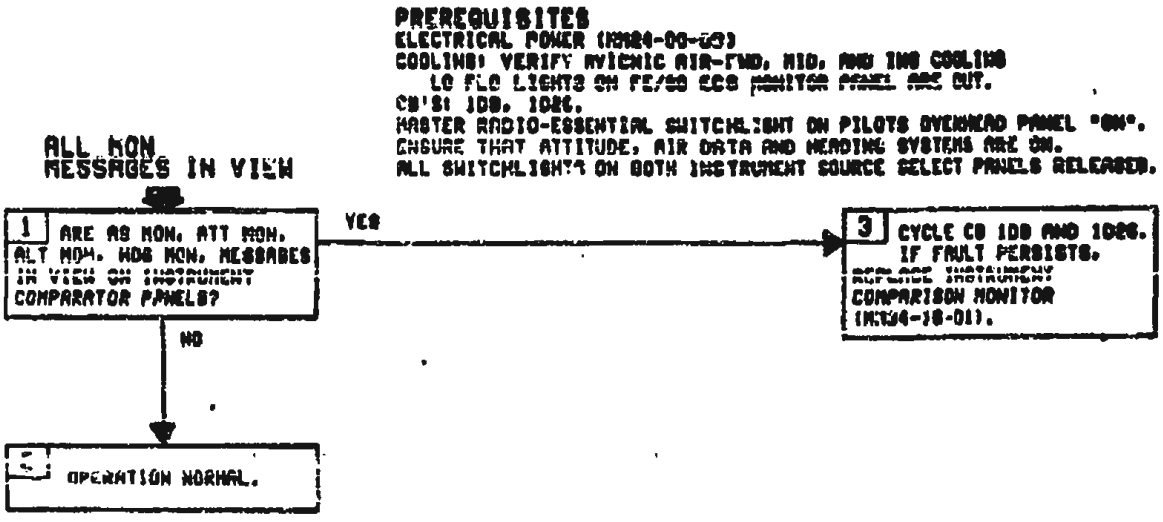
R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD AND MID LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D5, 1D7, 1D8, 1D9, 1D26, 1D27, 1F3, 1F5, 1F21, 1G23, 1G28, 1J18, 1K19, 1K24, 2A21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
VERIFY ATTITUDE AND HEADING SYSTEMS ARE OPERATING


HDG MON MESSAGE PROBLEMS
1 IS HDG MON MESSAGE IN VIEW ON INSTRUMENT COMPARATOR PANELS?
YES
NO
2 OPERATION NORMAL.
3 DO BOTH INSTRUMENT COMPARATOR PANELS DISPLAY HDG MON?
NO
YES
4 PERFORM TEST 2 ON EITHER INSTRUMENT COMPARATOR PANEL.
REPLACE COMPARATOR PANEL THAT FAILS TEST (MM34-16-02).
5 REPLACE F/O HSI (MM34-55-04).
IF FAULT PERSISTS, REPLACE CAPT HSI (MM34-55-04).
IF HDG MON IS STILL DISPLAYED, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
IF FAULT STILL EXISTS, CHECK 26V AC REF. WIRING FROM ICM TO CAPT AND F/O HSIs.

M1-0008-34-1446

R HDG MON Message Problems
R Figure 115

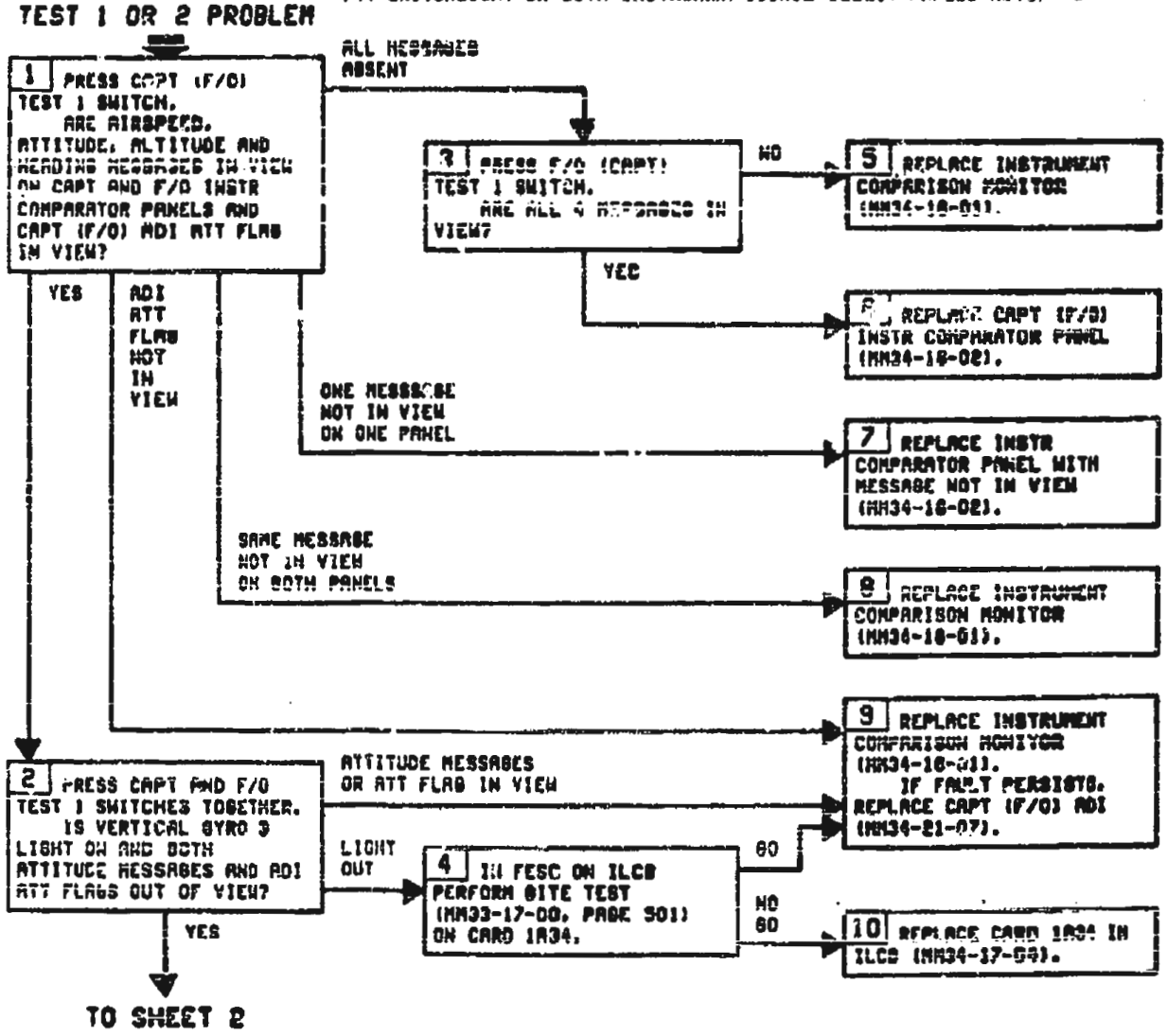

PREREQUISITES
ELECTRICAL POWER (34-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND IND COOLING
LO FLO LIGHTS ON FE/SD ECS MONITOR PANEL ARE OUT.
CB'S: 1D8, 1D26.
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON".
ENSURE THAT ATTITUDE, AIR DATA AND HEADING SYSTEMS ARE ON.
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED.
ALL MON
MESSAGES IN VIEW
1
ARE AS MON, ATT MON, ALT MON, HDG MON, MESSAGES IN VIEW ON INSTRUMENT COMPARATOR PANELS?
YES
3
CYCLE CB 1D8 AND 1D26. IF FAULT PERSISTS, REPLACE INSTRUMENT COMPARISON MONITOR (34-16-01).
NO
5
OPERATION NORMAL.

HI-2608-34 1313

All MON Messages in View
Figure 116

EFFECTIVITY: ALL

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND IN2 COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D6, 1D26, 1E1, 1E2, 1E6, 1E7, 1E24, 1E25, 1F8, 1F20, 1B6, 1B26, 1B25, 2B21
MASTER RADIO-ESSENTIAL SWITCHLIGHT ON PILOTS OVERHEAD PANEL "ON"
ATT SWITCHLIGHT ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED

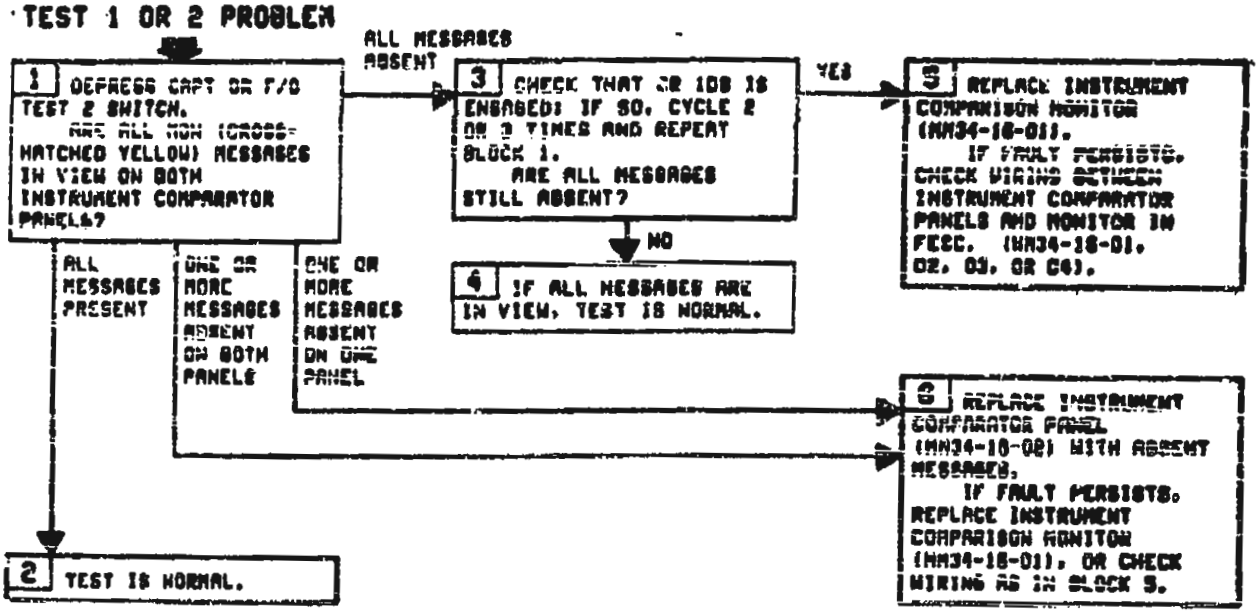

TEST 1 OR 2 PROBLEM
1 PRESS CAPT (F/O) TEST 1 SWITCH. ARE AIRSPEED, ATTITUDE, ALTITUDE AND HEADING MESSAGES IN VIEW ON CAPT AND F/O INSTR COMPARATOR PANELS AND CAPT (F/O) ADI ATT FLAG IN VIEW?
ALL MESSAGES ABSENT
3 PRESS F/O (CAPT) TEST 1 SWITCH. ARE ALL 4 MESSAGES IN VIEW?
NO
5 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
YES
6 REPLACE CAPT (F/O) INSTR COMPARATOR PANEL (MM34-16-02).
YES
ADI ATT FLAG NOT IN VIEW
ONE MESSAGE NOT IN VIEW ON ONE PANEL
7 REPLACE INSTR COMPARATOR PANEL WITH MESSAGE NOT IN VIEW (MM34-16-02).
SAME MESSAGE NOT IN VIEW ON BOTH PANELS
8 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
9 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01). IF FAULT PERSISTS, REPLACE CAPT (F/O) ADI (MM34-21-07).
2 PRESS CAPT AND F/O TEST 1 SWITCHES TOGETHER. IS VERTICAL GYRO 3 LIGHT ON AND BOTH ATTITUDE MESSAGES AND ADI ATT FLAGS OUT OF VIEW?
ATTITUDE MESSAGES OR ATT FLAG IN VIEW
LIGHT OUT
4 IN FESC ON ILCB PERFORM BITE TEST (MM33-17-00, PAGE 501) ON CARD 1A34.
GO
NO GO
10 REPLACE CARD 1A34 IN ILCB (MM34-17-01).
YES
TO SHEET 2

RJ-2800-34-1447

R TEST 1 or 2 Problems
R Figure 117 (Sheet 1)

R EFFECTIVITY: ALL
R
C01B

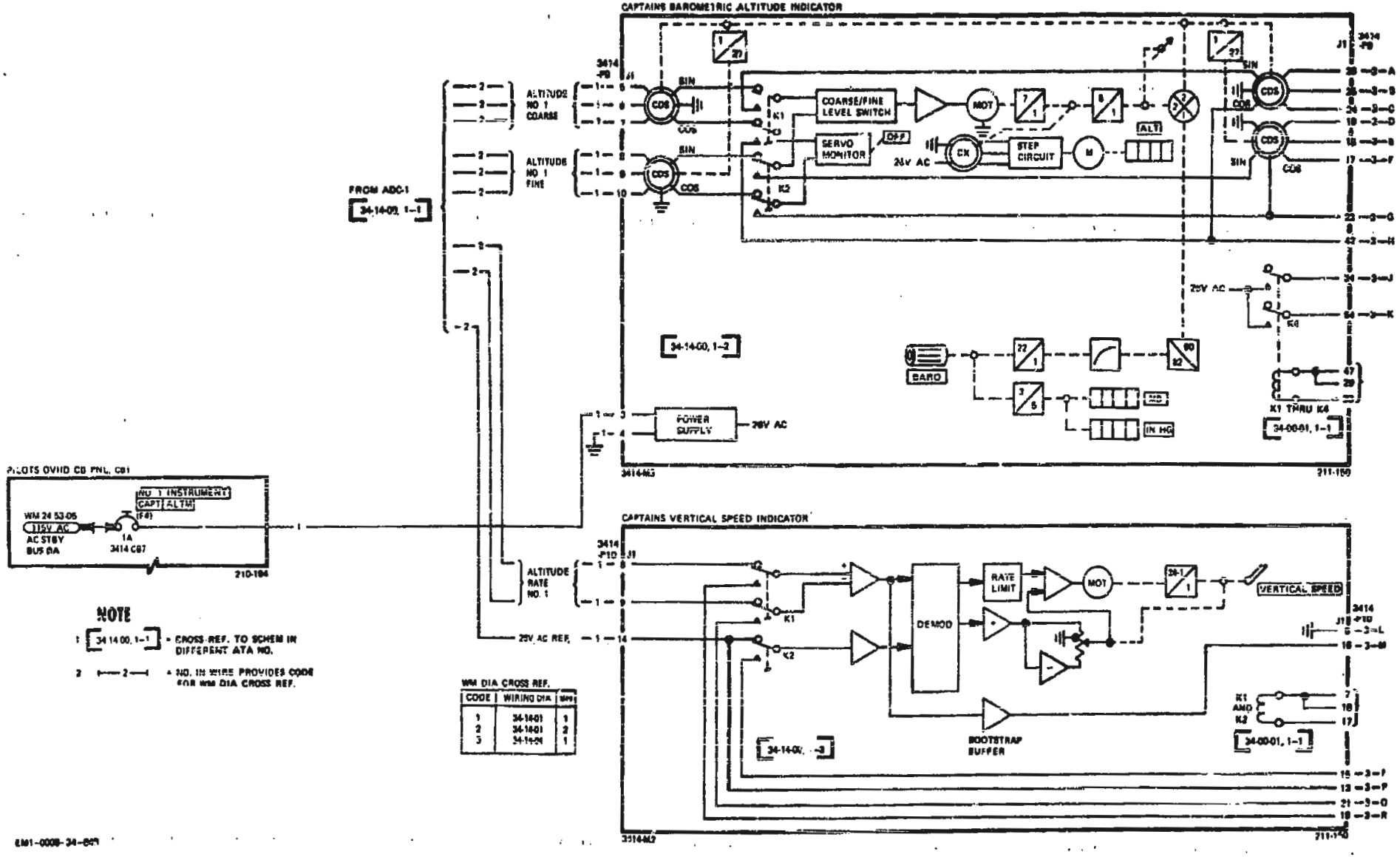
PREREQUISITES
SEE SHEET 1


TEST 1 OR 2 PROBLEM
1 DEPRESS CAPT OR F/O TEST 2 SWITCH.
ARE ALL NON (CROSS-HATCHED YELLOW) MESSAGES IN VIEW ON BOTH INSTRUMENT COMPARATOR PANELS?
ALL MESSAGES PRESENT
ONE OR MORE MESSAGES ABSENT ON BOTH PANELS
ONE OR MORE MESSAGES ABSENT ON ONE PANEL
ALL MESSAGES ABSENT
3 CHECK THAT CB 108 IS ENGAGED; IF SO, CYCLE 2 OR 3 TIMES AND REPEAT BLOCK 1.
ARE ALL MESSAGES STILL ABSENT?
YES
5 REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01).
IF FAULT PERSISTS, CHECK WIRING BETWEEN INSTRUMENT COMPARATOR PANELS AND MONITOR IN FEEC. (MM34-16-01, 02, 03, OR 04).
NO
4 IF ALL MESSAGES ARE IN VIEW, TEST IS NORMAL.
2 TEST IS NORMAL.
6 REPLACE INSTRUMENT COMPARATOR PANEL (MM34-16-02) WITH ABSENT MESSAGES.
IF FAULT PERSISTS, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-16-01), OR CHECK WIRING AS IN BLOCK 5.

M1-2000-34-1481

TEST 1 or 2 Problems
Figure 117 (Sheet 2)

EFFECTIVITY: ALL



R Instrument Comparison Monitor Schematic (Altitude Channel)
R SCHEM 1 (Sheet 1)

R EFFECTIVITY: ALL

0018

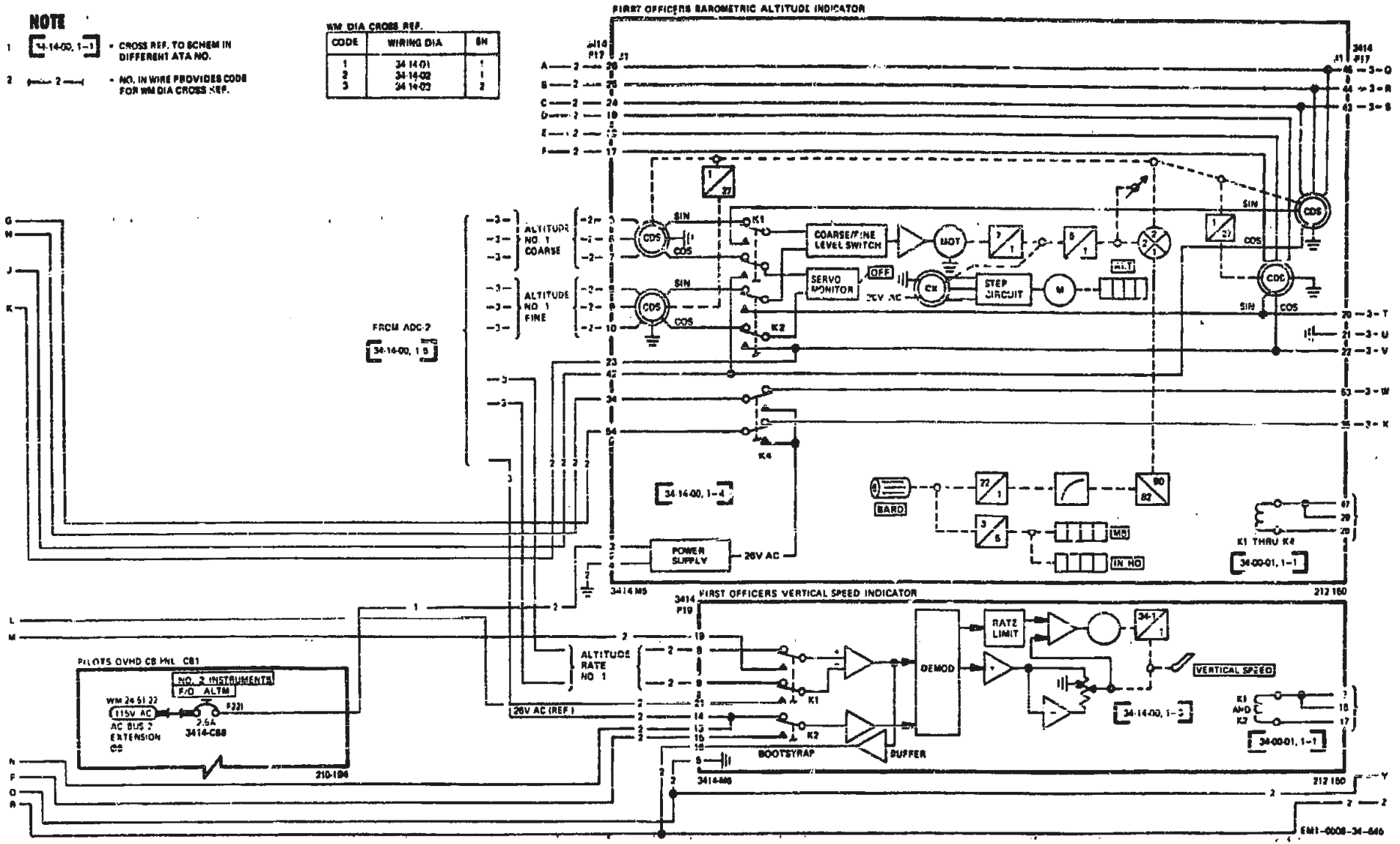
NOTE

1 [34-14-00, 1-1] * CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

2 —2— * NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

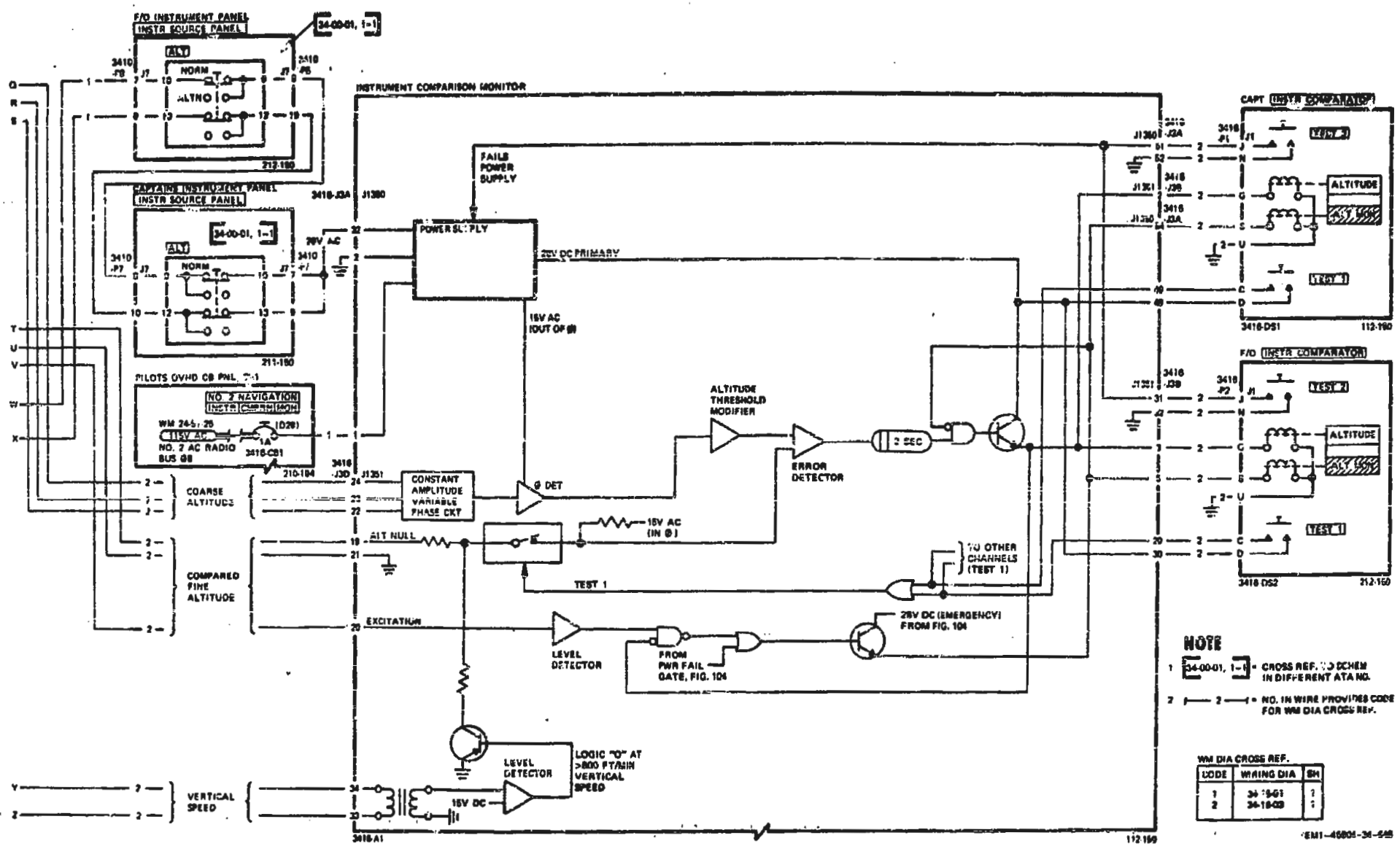
WM DIA CROSS REF.

CODE	WIRING DIA	GA
1	34-14-01	1
2	34-14-02	1
3	34-14-03	2



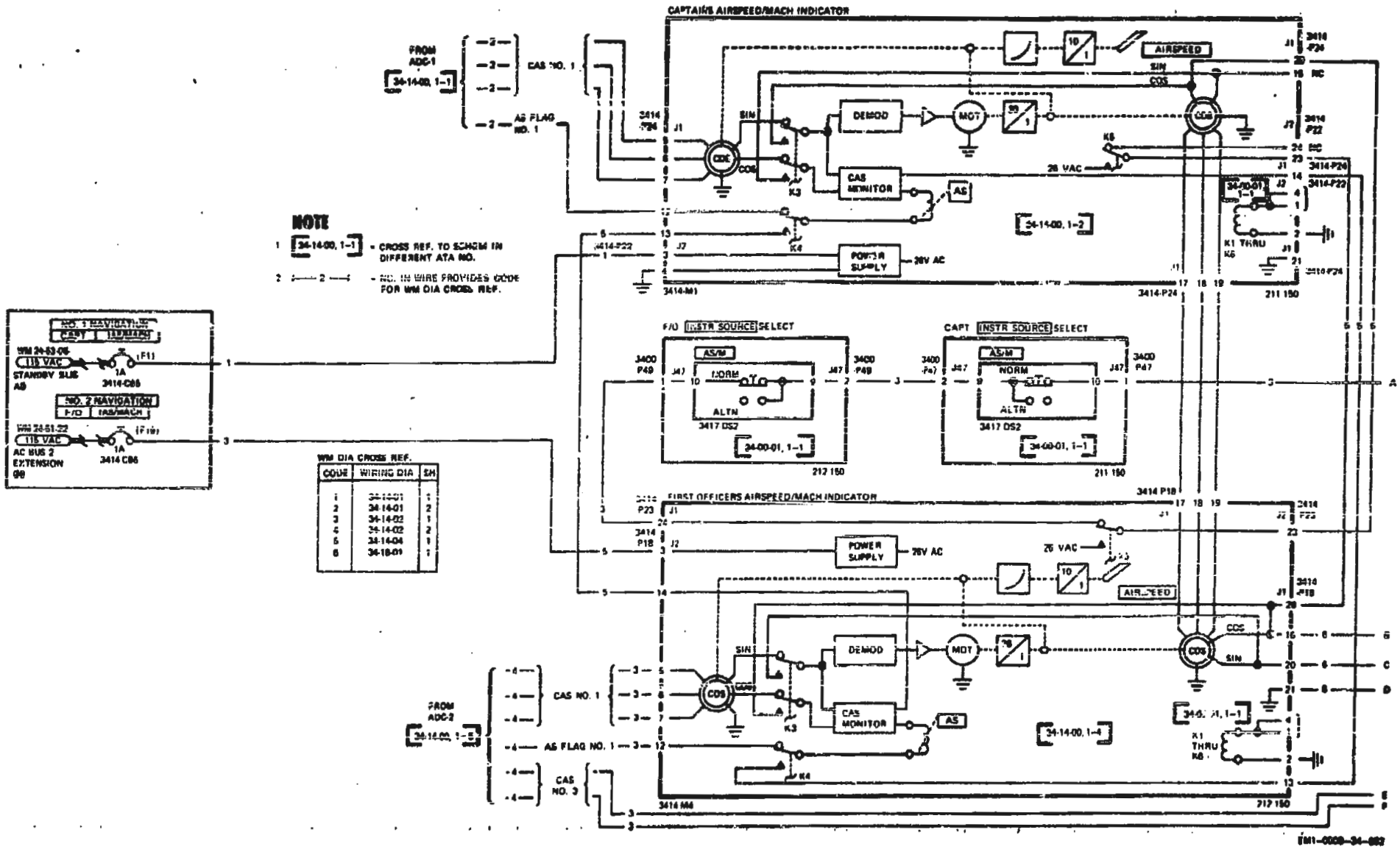
R Instrument Comparison Monitor Schematic (Altitude Channel)
R SCHEM 1 (Sheet 2)

R EFFECTIVITY: ALL
R
R
001B

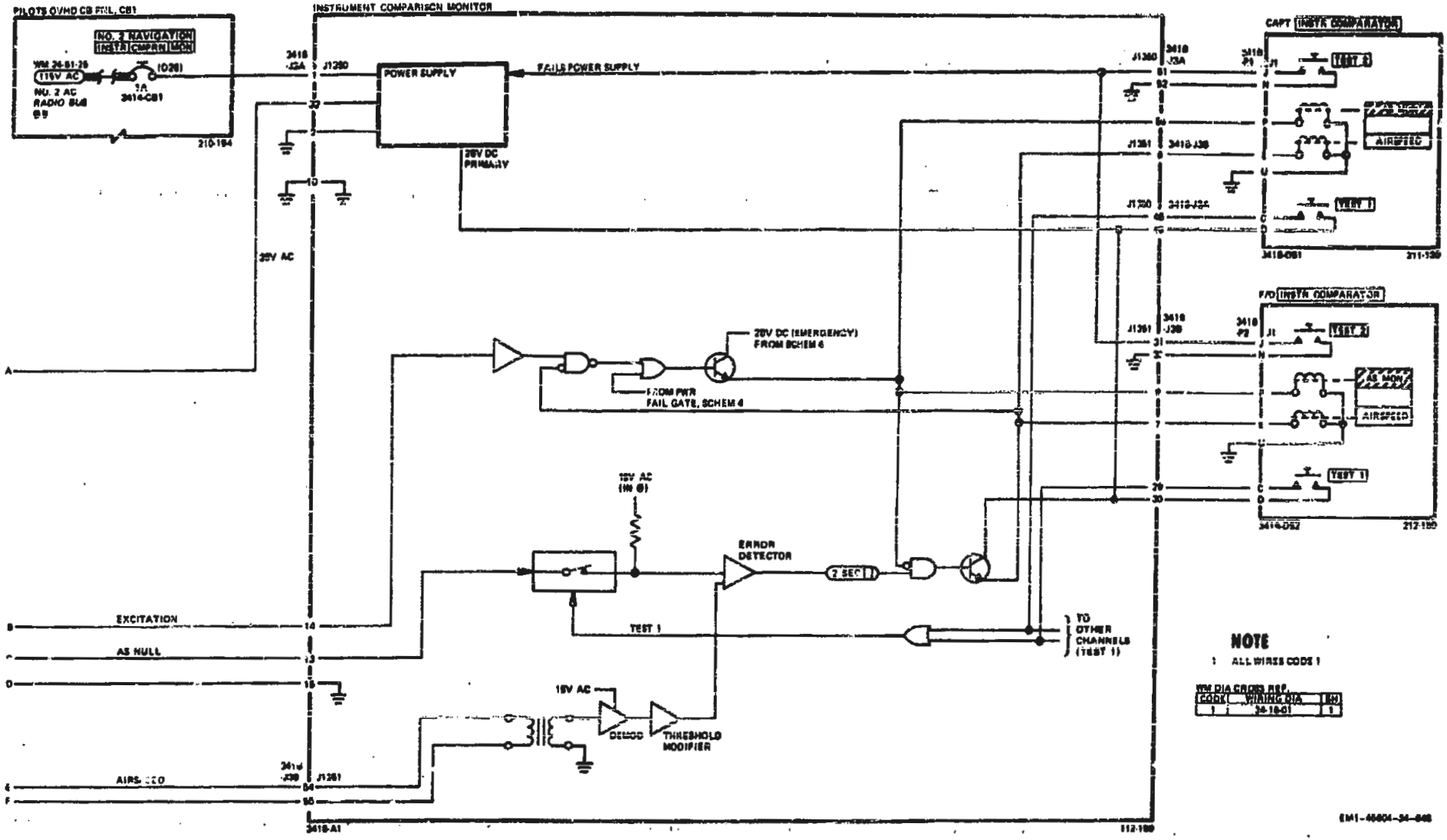


Instrument Comparison Monitor Schematic (Altitude Channel)
SCHEM 1 (Sheet 3)

EFFECTIVITY: ALL

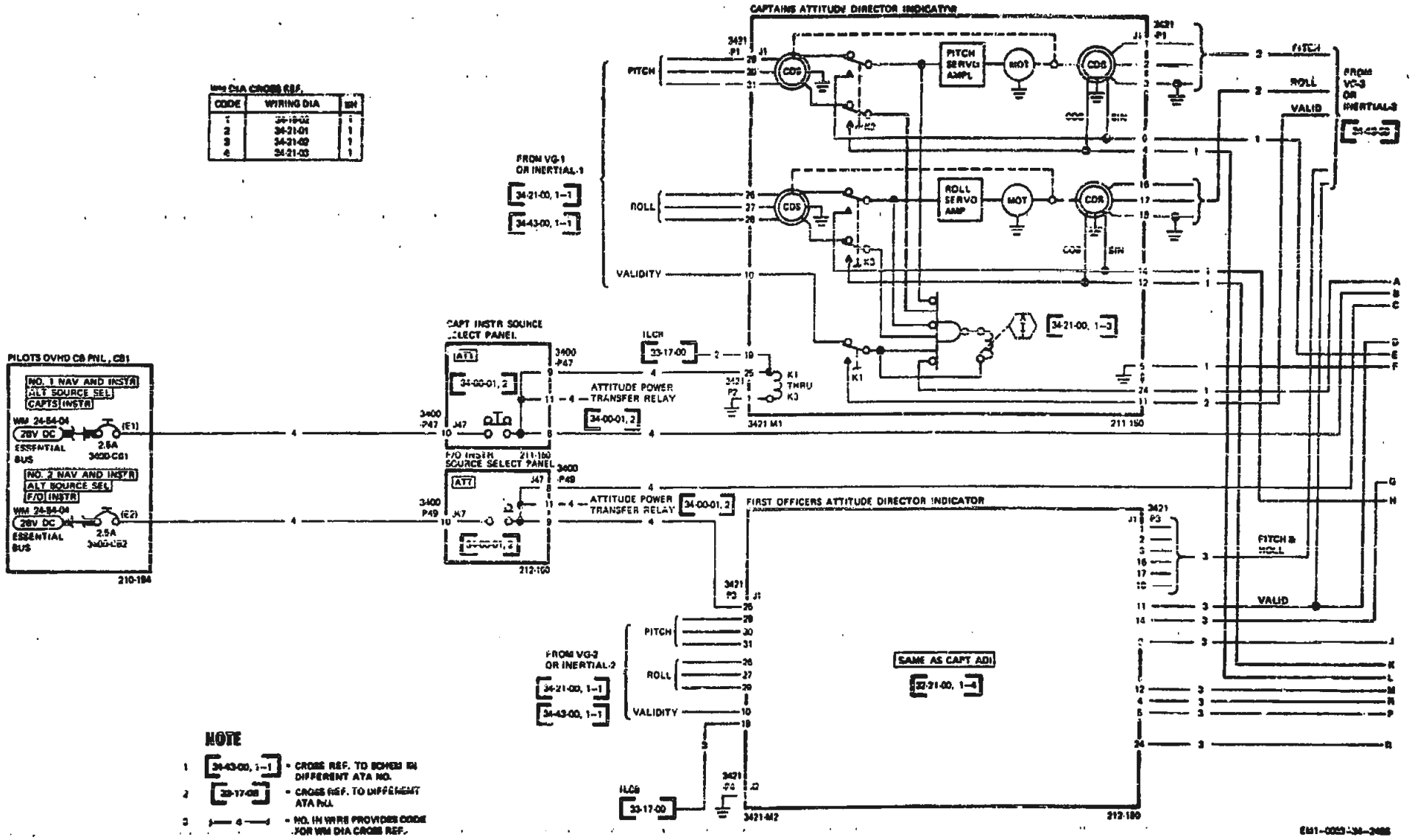


Instrument Comparison Monitor Schematic (Airspeed Channel)
SCHEM 2 (Sheet 1)



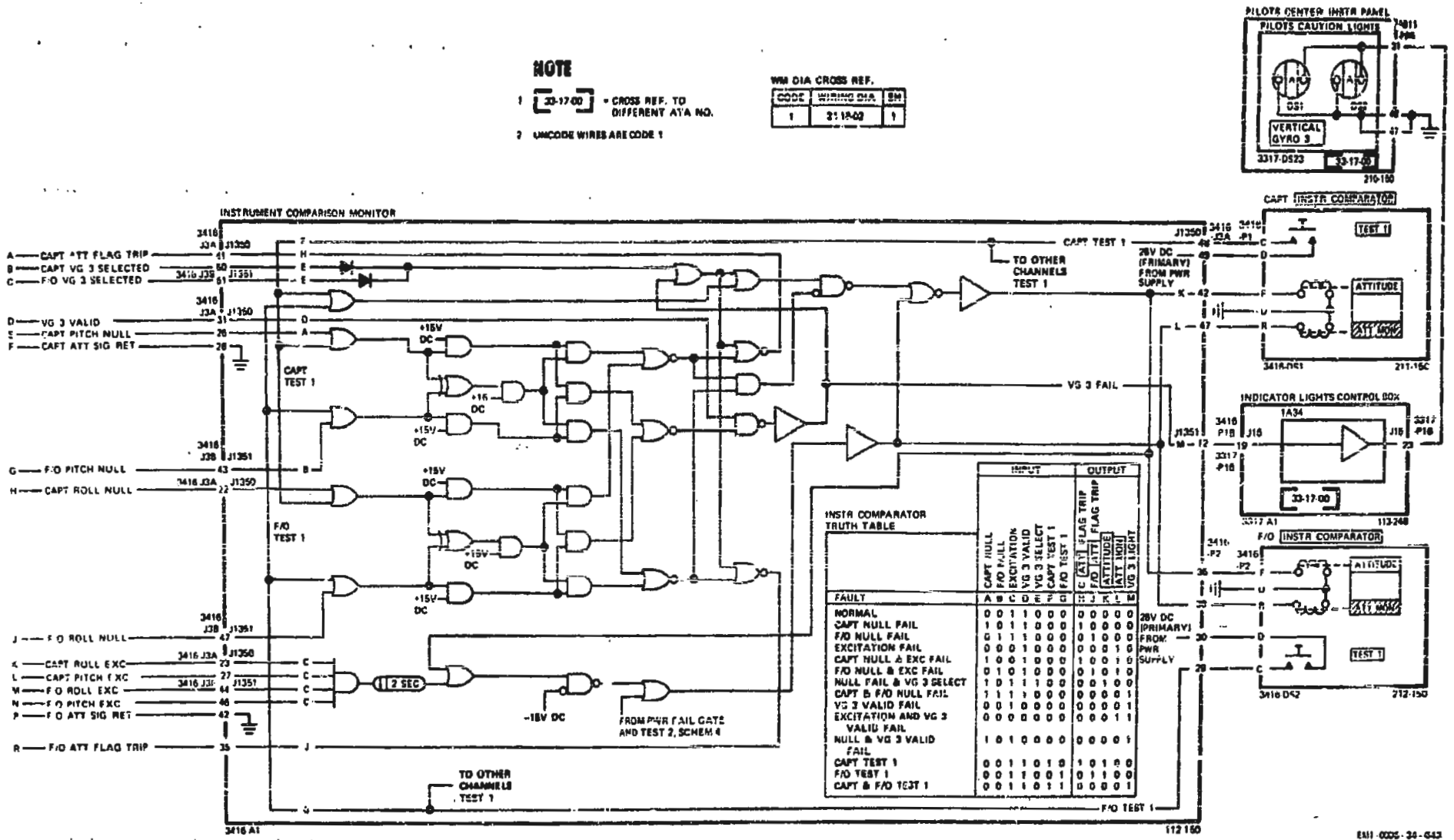
R Instrument Comparison Monitor Schematic (Airspeed Channel)
R SCHEM 2 (Sheet 2)

R EFFECTIVITY: ALL
R
001A



Instrument Comparison Monitor Schematic (Attitude Channel)
SCHEM 3 (Sheet 1)

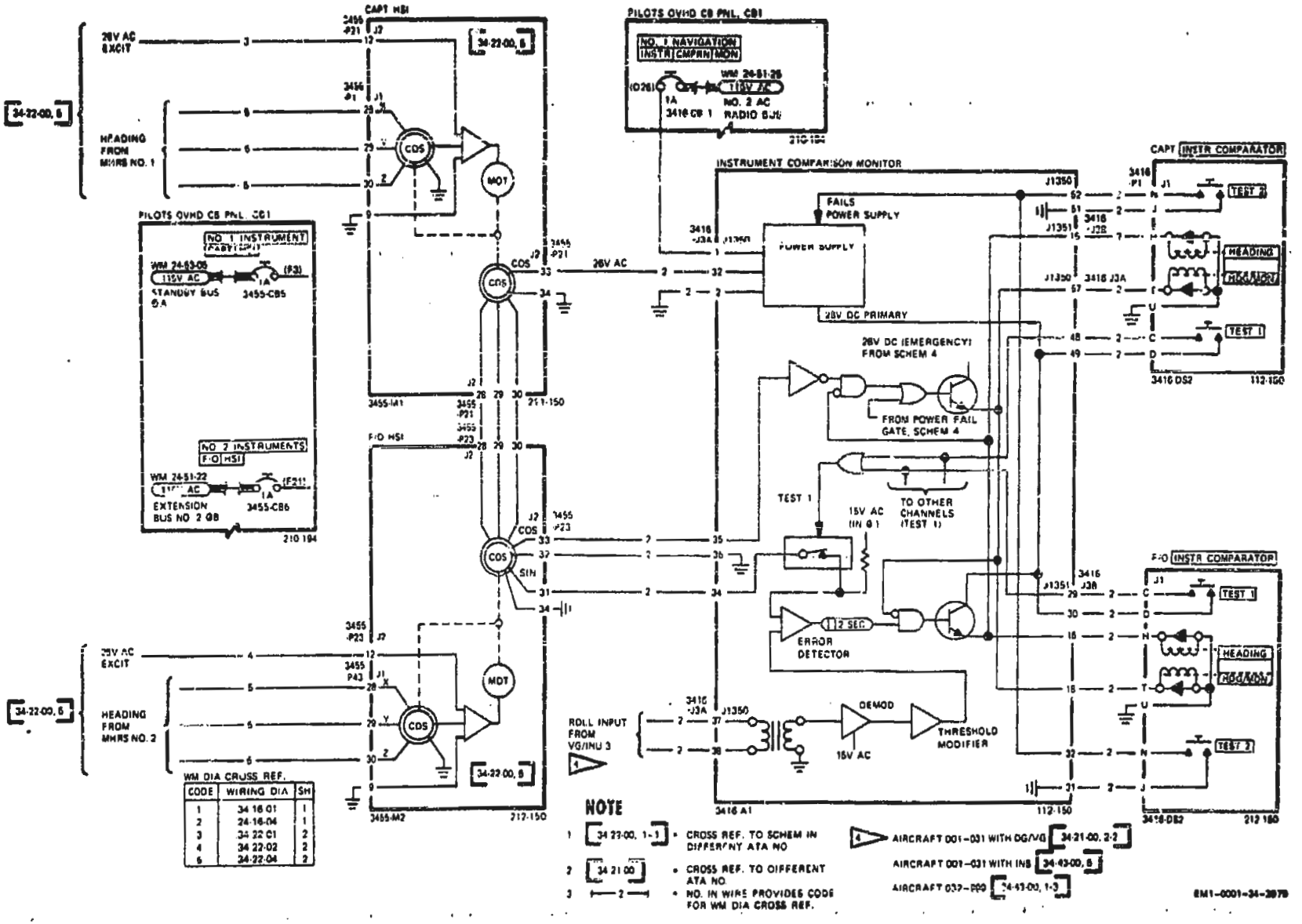
R EFFECTIVITY: ALL
R
OC18



R Instrument Comparison Monitor Schematic (Attitude Channel).
R SCHEM 3 (Sheet 2)

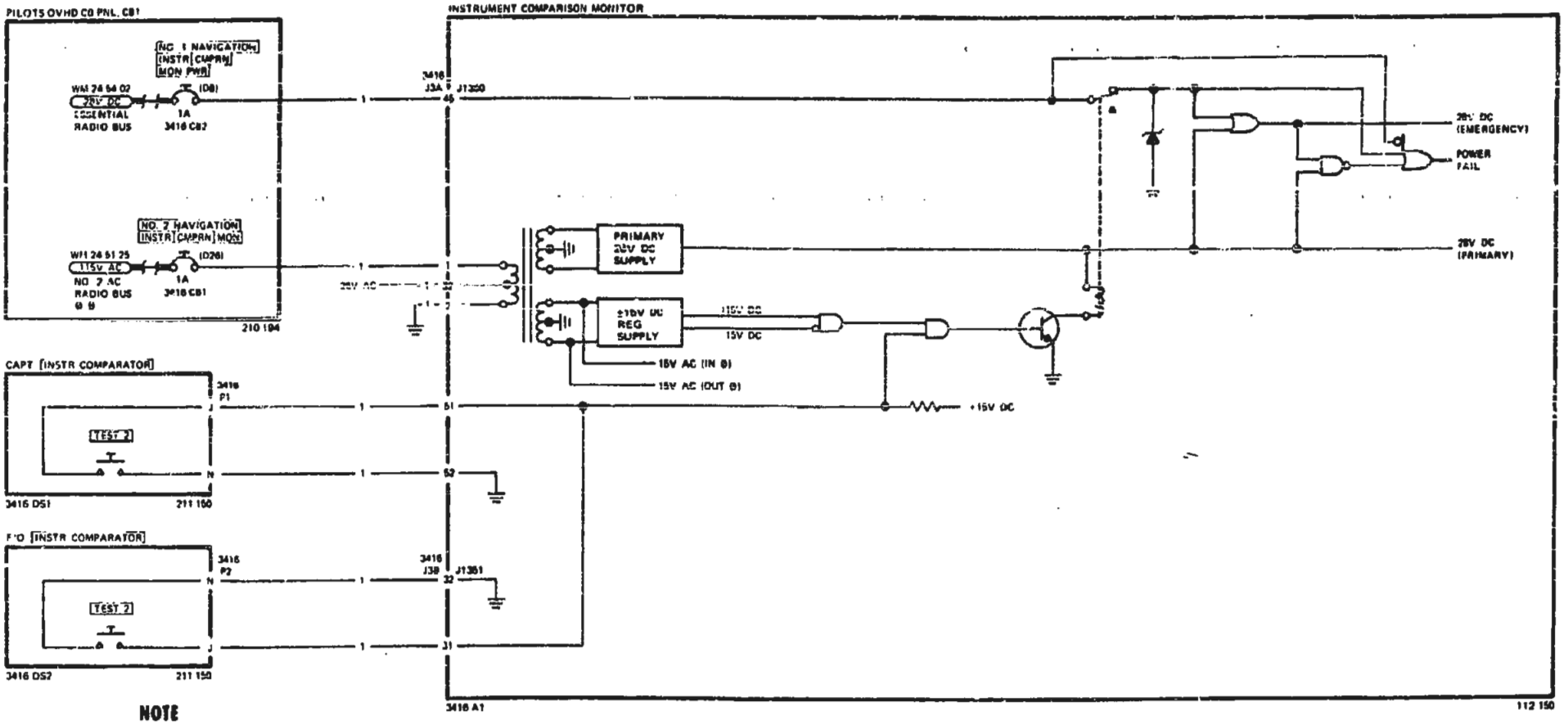
R EFFECTIVITY: ALL

0018


CAPT HSI
PILOTS OVHD CB PNL. CB1
NO. 1 NAVIGATION INSTR CMPRN MON
INSTRUMENT COMPARISON MONITOR
CAPT INSTR COMPARATOR
F/O INSTR COMPARATOR
F/O HSI
28V AC EXCIT
HEADING FROM MHRS NO. 1
HEADING FROM MHRS NO. 2
NO. 1 INSTRUMENT
NO. 2 INSTRUMENTS F/O HSI
STANDBY BUS
EXTENSION BUS NO 2 CB
FAILS POWER SUPPLY
POWER SUPPLY
28V DC PRIMARY
28V DC (EMERGENCY) FROM SCHEM 4
FROM POWER FAIL GATE, SCHEM 4
TEST 1
TO OTHER CHANNELS (TEST 1)
ERROR DETECTOR
2 SEC
DEMOD
THRESHOLD MODIFIER
ROLL INPUT FROM VG/INU 3
HEADING
TEST 1
TEST 2
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 34 16 01 | 1
2 | 24-16-04 | 1
3 | 34 22 01 | 2
4 | 34 22-02 | 2
5 | 34-22-04 | 2
NOTE
1 CROSS REF. TO SCHEM IN DIFFERENT ATA NO
2 CROSS REF. TO DIFFERENT ATA NO
3 NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
AIRCRAFT 001-031 WITH DG/VG
AIRCRAFT 001-031 WITH INS
AIRCRAFT 032-999

Instrument Comparison Monitor Schematic (Heading Channel)
SCHEM 4

R EFFECTIVITY: ALL
R
001B



EM1-0107-34-620

R Instrument Comparison Monitor Power Supply Schematic
R SCHEM 5

R EFFECTIVITY: ALL
R
001B

CENTRAL INSTRUMENT WARNING SYSTEM - ADJUSTMENT AND TEST

1. General

R The central instrument warning system (CIWS) receives inputs from four systems: Altitude, Airspeed (Ref. 34-14-00), Attitude (Ref. 34-21-00), and Heading (Ref. 34-22-00). These systems must be operating properly to prevent false indications while testing the CIWS.

2. Referenced Procedure

24-00-00 Electrical Power System - Maintenance Practices

3. Adjustment/Test

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify AVIONICS AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out.

CAUTION: BEFORE TURNING HSIs, ADIs OR RDDMIs ON, VERIFY CB INSTR COOLING (A21) ON FE/SO OVERHEAD CIRCUIT BREAKER PANEL, CB2, ZONE 215, IS ON.

R (3) On aircraft with INS,
R on FE/SO overhead circuit breaker panel CB2, zone 215,
R verify circuit breakers INS CONT (C19) and INS FAN
R (C21) are closed.

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify following circuit breakers are closed:

DIR GYRO (G5) aircraft without inertials

VG/INS-1 (G6)

CMPS COUPLER (G7)

AIR DATA CMPTR (G8)

CAPT IAS/MACH (F1)

CAPT ADI (F2)

CAPT HSI (F3)

CAPT ALTM (F4)

INSTR XFMR NO. 1 (F5)

F/O RDDMI (E3)

VERT SP IND (E4)

R INS PWR (E6) aircraft with INS

R INS HTR (E7) aircraft with INS

INSTR CMPRN MON PWR (D8)

INSTR XFMR NO. 2 (D9)

CMPS CPLR-2 (J19)

CMPS CPLR-1 (K19)

CMPS CPLR-1 (K24)

R DIR GYRO (G23) aircraft without inertials

INS/VERT GYRO (G24)

R INS HTR (G25) aircraft with INS

CMPS CPLR (G26)

AIR DATA CMPTR (G27)

F/O IAS/MACH (F19)

F/O ADI (F20)

F/O HSI (F21)

F/O ALTM (F22)

CAPT RDDMI (E20)

VERT SP IND (E21)

INS-3/GYRO-3 (E24)

R INS-3 HTR (E25) aircraft with INS

INSTR CMPRN MON (D26)

INSTR XFMR NO. 3 (D27)

R (5) On aircraft with inertials, turn inertial systems on; on other aircraft, verify VGs are operating. Verify operation of third attitude reference unit by selecting ATT ALTN on both instrument source select panels and check for ADI - ATT flag retraction.

R (6) Verify four systems are operating properly by absence of flags on the following instruments:

Air Data Computer System

Barometric Altitude Indicators

Airspeed/Mach Indicators

Vertical Speed Indicators

Attitude Reference System

ADI - ATT flags only need be out of view

Magnetic Heading Reference System

HSI - HDG flags only need be out of view

RDDMI - HDG flags only need be out of view

B. BITE

(1) Perform preparation (Paragraph 3A).

R (2) Verify all annunciators on Captains and First Officers INSTR COMPARATOR indicators display black (no messages). Verify Captains and First Officers ADI do not show ATT flags.

(3) On Captains instrument panel, depress TEST 1 switch on INSTR COMPARATOR.

R (4) Verify all annunciators on Captains and First Officers INSTR COMPARATOR indicators display yellow background with messages as follows: AIRSPEED, ATTITUDE, ALTITUDE, and HEADING.

Verify Captains ADI ATT flag in view.

R Release TEST 1 switch.

(5) On First Officers instrument panel, depress TEST 1 switch on INSTR COMPARATOR.

(6) Repeat Step 3B(4).

Release TEST 1 switch.

(7) On Captains instrument panel, depress TEST 2 switch on INSTR COMPARATOR.

(8) Verify all annunciators on Captains and First Officers INSTR COMPARATOR display crosshatched yellow messages as follows: AS MON, ATT MON, ALT MON, and HDG MON.

Release TEST 2 switch.

(9) On First Officers instrument panel, depress TEST 2 switch on INSTR COMPARATOR.

(10) Repeat Step 3B(8).

Release TEST 2 switch.

(11) On Captains and First Officers instrument panel, depress TEST 1 switches on INSTR COMPARATOR indicators together.

(12) Verify VERTICAL GYRO 3 light on pilots caution and warning panel comes on.

Verify Captains and First Officers ADI ATT flags are out of view. Verify ATTITUDE messages on both INSTR COMPARATORS are out of view.

Release both TEST 1 switches.

(13) Turn off electrical power (Ref. 24-00-00).

(14) Open circuit breakers closed in Step 3A(3) and (4).

R R R R CAUTION: INERTIAL BATTERIES MAY DISCHARGE UPON POWER REMOVAL IF MODE SWITCH IS NOT SET TO OFF. THE CIRCUIT BREAKERS ON THE BATTERY UNITS SHOULD BE DISENGAGED TO PRECLUDE INADVERTENT DISCHARGE.

(15) Turn off inertial systems if installed.

INSTRUMENT COMPARISON MONITOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-16-00 Central Instrument Warning System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION INSTR CMPRN MON PWR (D8) and NO. 2 NAVIGATION INSTR CMPRN MON (D26).

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate instrument comparison monitor on forward rack shelf 2 (Ref. Fig. 401).

(3) Loosen and disengage knurled knob securing instrument comparison monitor to rack mount.

(4) Pull instrument comparison monitor forward until rear connectors are disengaged from mating mount connectors. Remove instrument comparison monitor.

B. Installation

(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Position instrument comparison monitor on rack mount and slide into position, aligning rear connectors with mating mount connectors.

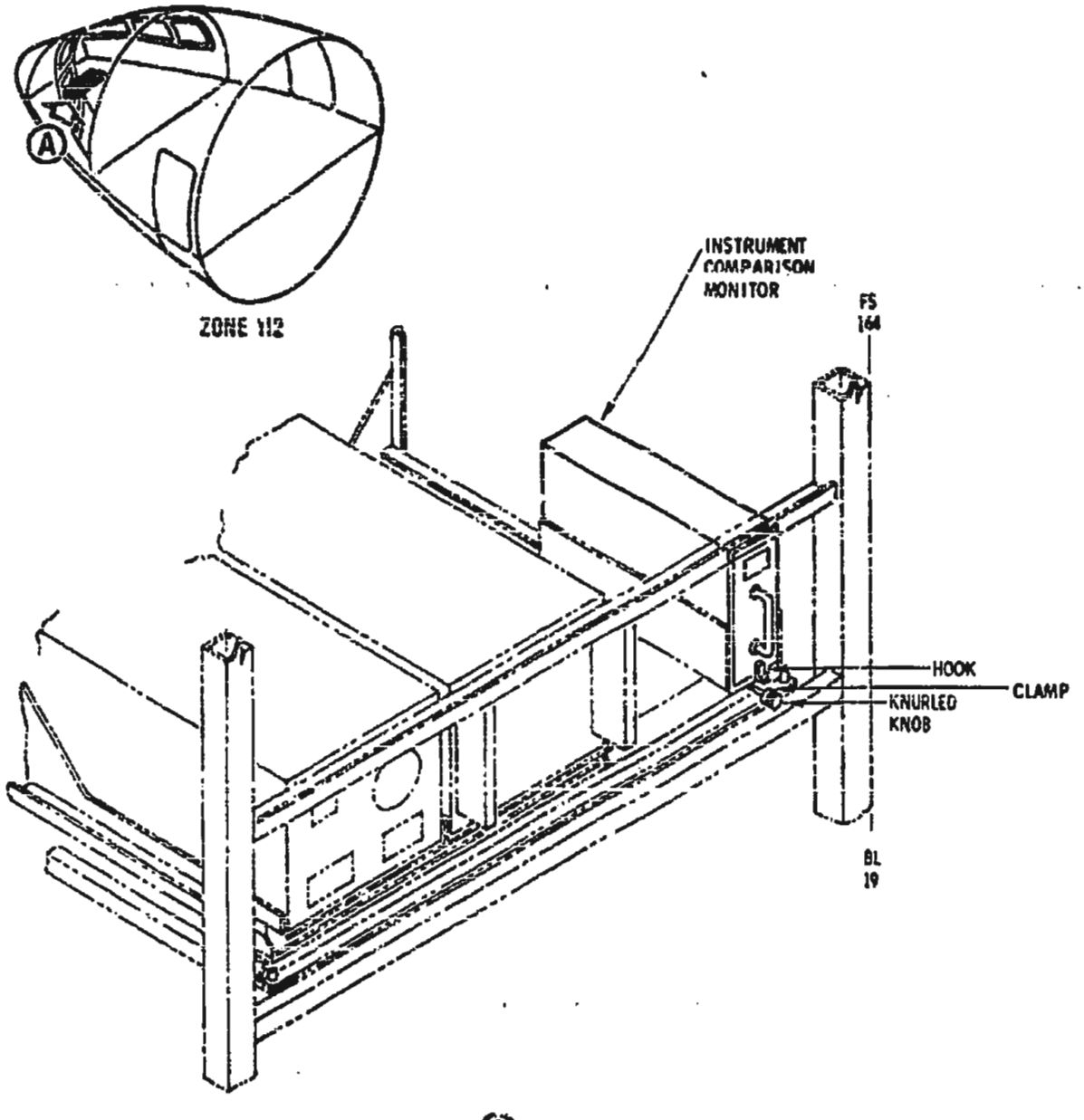
(3) Place mount clamp over instrument comparison monitor hook.

(4) Tighten knurled knob securing instrument comparison monitor to mount.

(5) Close and secure access door.

(6) Remove tags and close circuit breakers opened in Step 2A(1).

R (7) Perform Central Instrument Warning System BITE check (Ref. 34-16-00,501) Adjustment and Test, Step 3B.



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M1-0100-34-171

Instrument Comparison Monitor - Removal and Installation
Figure 401

INSTRUMENT FAILURE WARNING INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-16-00 Central Instrument Warning System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION INSTR CMPRN MON PWR (D8) and NO. 2 NAVIGATION INSTR CMPRN MON (D26).

(2) Locate instrument failure warning indicator (INSTR COMPARATOR) on Captains instrument panel, zone 211, and First Officers instrument panel, zone 212 (Ref. Fig. 401).

(3) Loosen round head clamp screws securing INSTR COMPARATOR indicator to Captains or First Officers instrument panel.

(4) Pull INSTR COMPARATOR indicator out of recess in Captains or First Officers instrument panel and disconnect connector from receptacle.

B. Installation

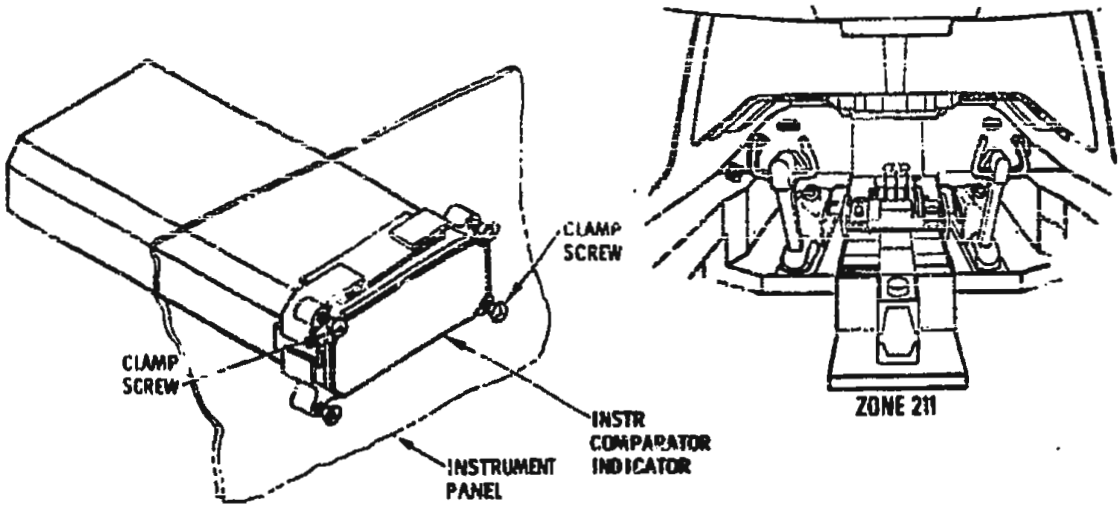
R (1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect aircraft connector to receptacle on INSTR COMPARATOR indicator.

(3) Place INSTR COMPARATOR indicator in recess on Captains or First Officers instrument panel, slide into
R position, secure by tightening clamp screws.

(4) Remove tags and close circuit breakers opened in Step 2A(1).

R (5) Perform Central Instrument Warning System BITE check (Ref. 34-16-00).



M1-0101-34-172

R Instrument Failure Warning Indicator
R Removal and Installation
R Figure 401

WINDSHEAR WARNING AND GUIDANCE SYSTEM - DESCRIPTION AND OPERATION

1. Description

A. General

The Windshear Warning and Guidance System consists of a windshear system computer (WSC) an accessory unit (WSAU), two red warning lights (WINDSHR), two amber caution lights (WINDSHR) and one amber fail light (WINDSHR CMPTR) (Ref. Fig. 1).

R The system also uses the command bars and the fast/slow pointer of each pilots ADI to display windshear escape guidance.

The WSC is located in the Forward Electronic Service Center (FESC) on shelf 4 of the rear avionics rack.

The WSAU is located in the FESC on the upper shelf of the directional gyro/INS battery rack.

One of each of the red warning and amber caution lights is located on each pilots instrument panel in a switchlight. The switch portion is the windshear system self test switch.

The amber WINDSHR CMPTR fail light is located with the other system fail lights, on the pilots caution and warning panel on the center instrument panel.

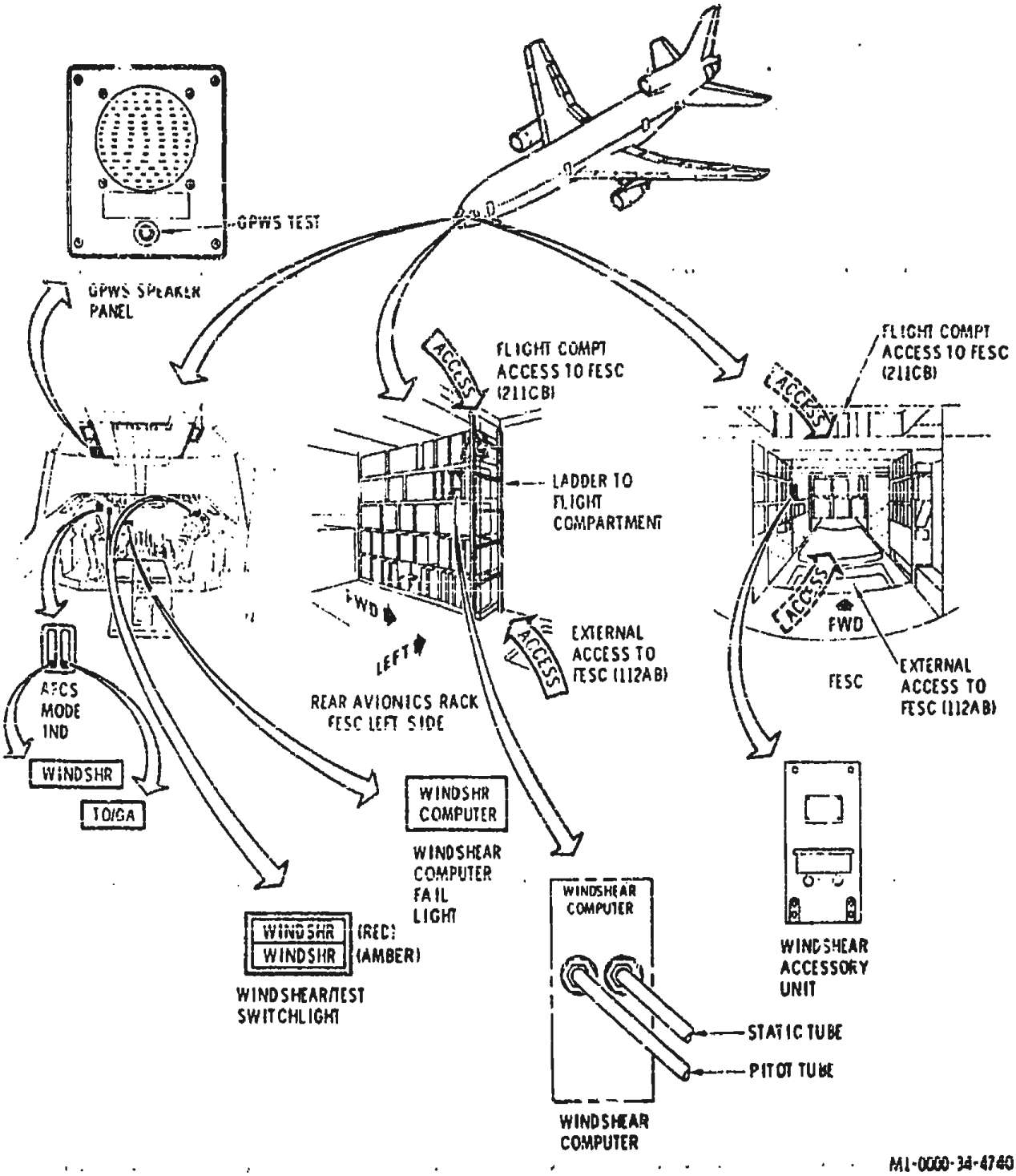
B. Windshear Theory

Windshear is a weather phenomenon that can on rare occasions pose a hazard to flight at low altitudes, especially in areas of the world where convective storms are prevalent.

Windshear has been defined as "a localized, low altitude rapid wind variation of short duration with the potential to dangerously affect the airspeed and vertical acceleration of an airborne aircraft".

Wind variations occur throughout the atmosphere from ground level to the outer reaches of the stratosphere. Low altitude variations resulting in windshear can pose a great hazard to flying aircraft, particularly if they occur in the vicinity of airports during aircraft takeoff and approach.

In order to maintain the proper perspective, however, it should be borne in mind that hazardous windshear encounters are rare in airline service.



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R
R

Component Location Diagram
Figure 1

EFFECTIVITY: AIRCRAFT WITH SB34-178 AND SB34-179

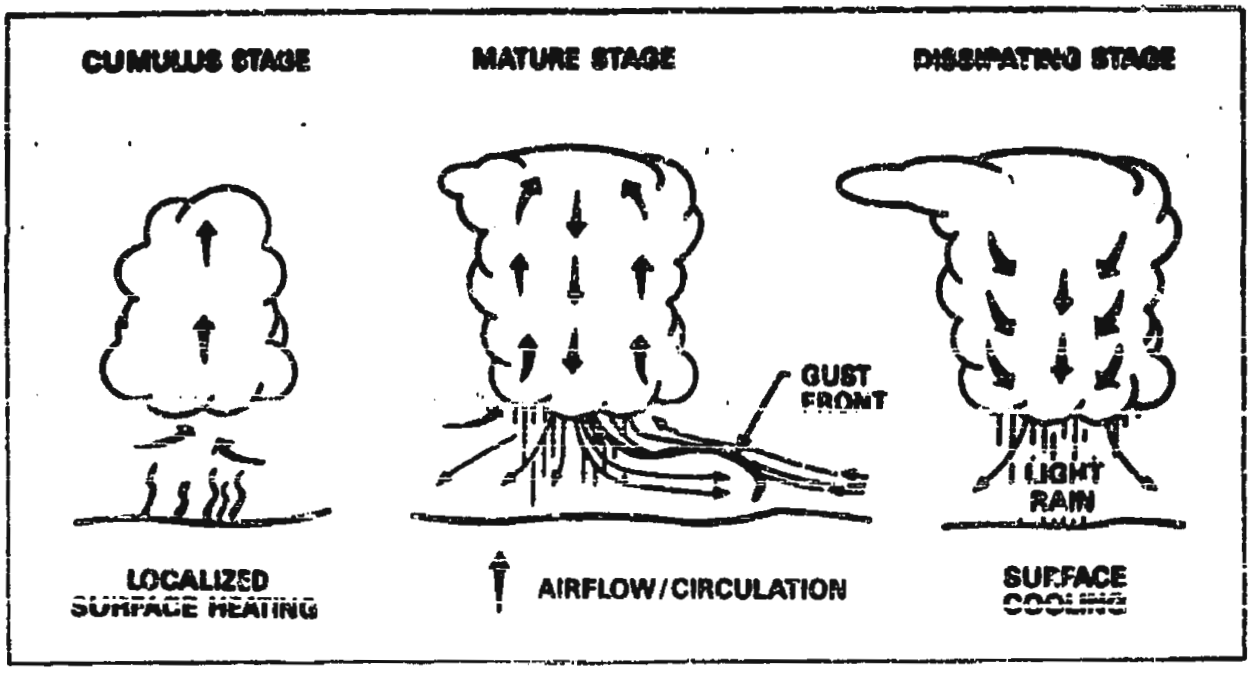
001B

Windshear can develop from a large variety of meteorological conditions, but examination of windshear-related aircraft accident and incident reports reveals that a large majority of the events were associated with thunderstorms. A windshear results when a precipitation-induced thunderstorm downdraft (rain and wind column) reaches the ground and the air is deflected outward in all directions, producing an outflow.

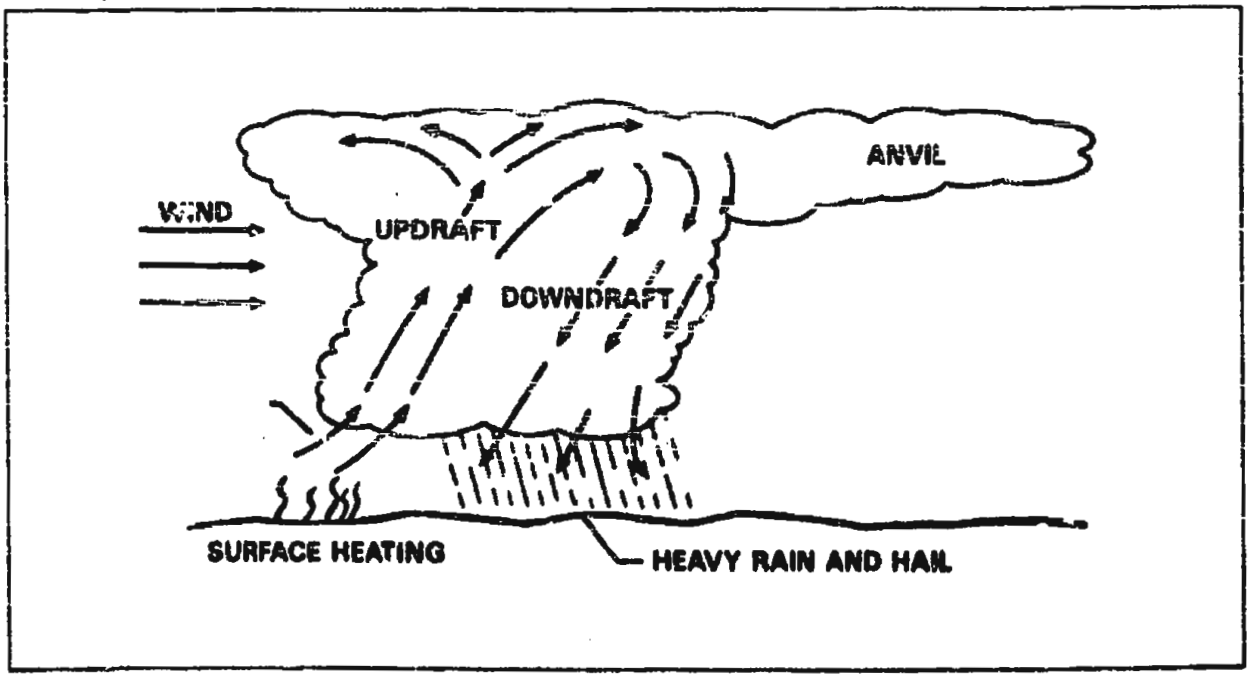
There are two basic types of thunderstorms: Airmass and Frontal. Airmass thunderstorms appear to be randomly distributed in unstable air and develop from heating of the earth's surface (Ref. Fig. 2). The heated air rises and cools to form cumulus clouds. As this stage continues to develop, precipitation forms in the higher portions of the cloud and falls. Precipitation signals the beginning of the mature stage and the presence of a downdraft. After approximately one hour, the heated updraft creating the thunderstorms dissipates. Many thunderstorms produce a cold air gust front as a result of the downflow and outrush of rain-cooled air. These gust fronts are usually very turbulent and can create serious threats to aircraft during takeoff and approach.

Frontal thunderstorms are usually associated with weather systems such as fronts, converging winds, and troughs aloft. They form in squall lines and last for several hours, generate heavy rain, sometimes hail, and produce strong gusty winds and sometimes tornados. Wind changes speed and direction at different altitudes in the frontal thunderstorm. This causes it to be vertically tilted and precipitation to fall away from the heated updraft, permitting a much longer period of development. The downward moving column of air, or downdraft, of a typical frontal thunderstorm is fairly large, from 1 to 5 miles in diameter. Resultant outflows accelerate to very high velocities that would result in large air speed changes in aircraft encountering them.

One kind of thunderstorm downdraft which is narrower and far more concentrated is known as a "microburst". It is the microburst that produces the most violent form of windshear. An aircraft entering the windshear area at low altitude would first encounter a head wind, resulting in an increase in air speed with a consequent increase in lift; which would soon be followed by a tail wind, resulting in a decrease in airspeed and a loss of lift. Figure 3 illustrates this situation and its possible consequences if no escape procedures are executed. In actuality, the airflows encountered by an aircraft in the windshear area would be considerably more complex.



Thunderstorm Development



Frontal Thunderstorm

M1-0000-34-4760

Thunderstorm Development
Figure 2

Downdraft associated with microbursts are typically only a few hundred to about 3,000 feet across.

When the downdraft reaches the ground and spreads out horizontally, it may produce one or more horizontal vortex rings around the downdraft. The outflow region is typically from 6,000 to 12,000 feet in diameter. The horizontal vortices may extend to over 2,000 feet above the ground.

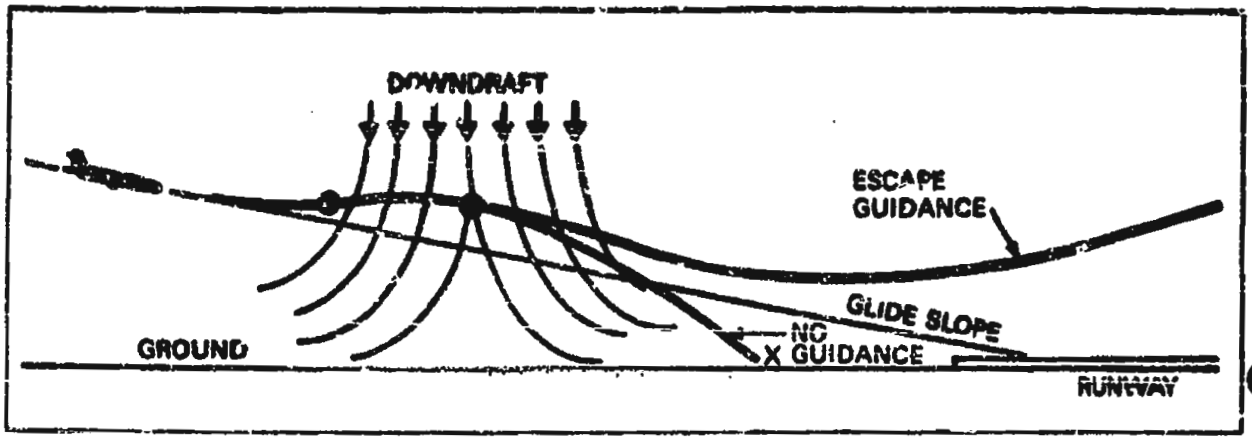
Microbursts are normally associated with heavy rain, as in thunderstorm conditions, but they also occur in relatively dry conditions of light rain or "virga" (precipitation that evaporates before reaching the ground). In this example the air below a cloud base of up to 15,000 feet above the ground is very dry and the precipitation from the higher convective clouds falls into this low humidity air and evaporates. The evaporative cooling causes the air to plunge downward. As the cooling process continues, the downdraft accelerates. These strong downdrafts resulting from virga conditions constitute a severe hazard to aircraft flying under convective clouds at altitudes much higher than those associated with the typical low altitude windshear.

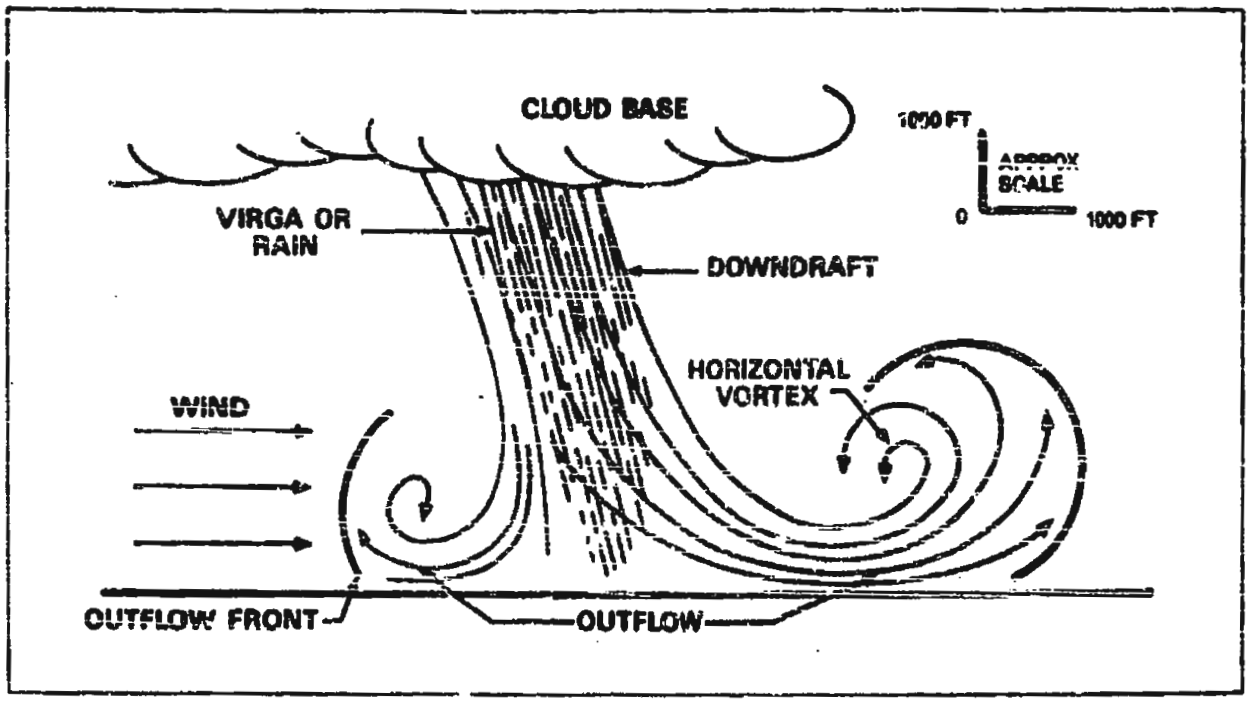
Microburst outflows are not always symmetrical, therefore, a significant airspeed increase may not always be experienced by an aircraft upon entering the outflow, or it may be much less than the subsequent airspeed loss experienced when exiting it.

More than one microburst can occur in the same thunderstorm area. If several are present, a series of horizontal vortices can form near the ground as a result of the microbursts overlapping or being embedded into each other. These vortices may induce very powerfull updrafts, roll forces and downdrafts.

Windspeeds progressively intensify for about 5 minutes after a microburst initially contacts the ground. For this reason, the windshear encountered by an aircraft during the initial stage of development may not be very intense, but another aircraft encountering the same windshear a few minutes later may experience an airspeed change two or three times greater. Microbursts usually dissipate within 10 to 20 minutes after initial ground contact.

Doppler radar wind measurements indicate that the average wind speed change that a pilot experiences flying through an average microburst windshear, at its point at peak intensity, is about 45 knots. However, wind speed differences of about 100 knots have been measured, and at a very severe event recorded at Andrews Air Force Base on August 1, 1983, headwind to tailwind differential velocities





Microburst and Downburst Windshear Effect During Landing Approach

M1-0000-34-4751

Landing Guidance and Microburst
Figure 5

of nearly 200 knots were measured. This strongly suggests that some windshear encounters cannot be successfully escaped, even with the best presently known techniques, and that avoidance is the best strategy in any windshear situation.

A major windshear encounter is a very rare event, currently thought to be once per pilot lifetime. Also, windshears can develop very quickly and can pose an immediate threat to the aircraft's flight path during approach and takeoff. Thus, when a windshear warning is activated, there is generally no time to ponder the situation or to consult manuals. It is obvious, therefore, that pilot operation of the controls in a windshear encounter must be natural and instinctive.

2. Operation

R NOTE: During sustained banks of greater than 15 degrees or
R during flap configuration changes, the Windshear
R Detection System is desensitized and alerts resulting
R from windshear conditions will be delayed.

A. Increasing Performance

Each pilot has an amber caution light and a red warning light which are activated by the windshear computer whenever a windshear of a magnitude beyond a predetermined threshold is detected in low altitude flight conditions (Ref. Fig. 4).

The amber lights will flash repeatedly whenever a significant increase in airplane performance is detected by the Windshear System. This would typically occur as the aircraft enters the outer edge of a microburst. Although the situation does not present an immediate hazard to the airplane, the amber caution alerts the flight crew to the possibility of a subsequent decreasing performance situation, which is potentially hazardous. An aborted takeoff or a normal go-around maneuver would be a suitable response to an amber caution. No windshear escape guidance is provided in this condition.

B. Decreasing Performance

The red lights will flash on and off repeatedly whenever significantly decreasing aircraft performance is detected, requiring immediate pilot action. An aborted takeoff or initiation of a windshear escape maneuver using full engine thrust would be the required response to the red warning. Windshear escape guidance is provided, if airborne, on the pilots ADI flight director command bars. Coincident with the red warning light illumination, an aural voice warning

of the word "Windshear" will sound three times via the cockpit loudspeaker, and will repeat after 30 seconds if a windshear condition is still present (Ref. Fig. 5).

C. Escape Guidance

A "pop-up" windshear guidance capability is provided whereby escape guidance is activated (Ref. Fig. 6) upon an airborne windshear red warning, even if the flight director has been selected off. The flight director command bars will rapidly travel (pop-up) to their initially computed escape guidance position on the ADIs when the throttles are manually advanced to maximum thrust in response to a red windshear warning. Operation of the APFDS Go-Around switch in response to a red windshear warning will also initiate escape guidance. Although the primary guidance is for the pitch axis, a wings level roll guidance is also provided to ensure a coordinated, maximum energy escape maneuver. To complement the command bar guidance, the ADI fast/slow indicators are used during windshear guidance to display angle of attack margin from the stick shaker, thus assisting the pilot to avoid a stall situation.

No autopilot coupling to the windshear escape guidance system is provided. If the autopilot is engaged at the time of the red warning, pilot operation of an autopilot disconnect switch will be necessary to obtain windshear guidance. If the autopilot is not disconnected during the aural windshear warnings, a voice prompt to disconnect the autopilot "DISCONNECT AUTOPILOT" will sound twice to remind the pilot to do so.

D. Windshear Visual Indications

Takeoff/Go-around - The amber or red flashing light will illuminate when:

A windshear condition is detected, and

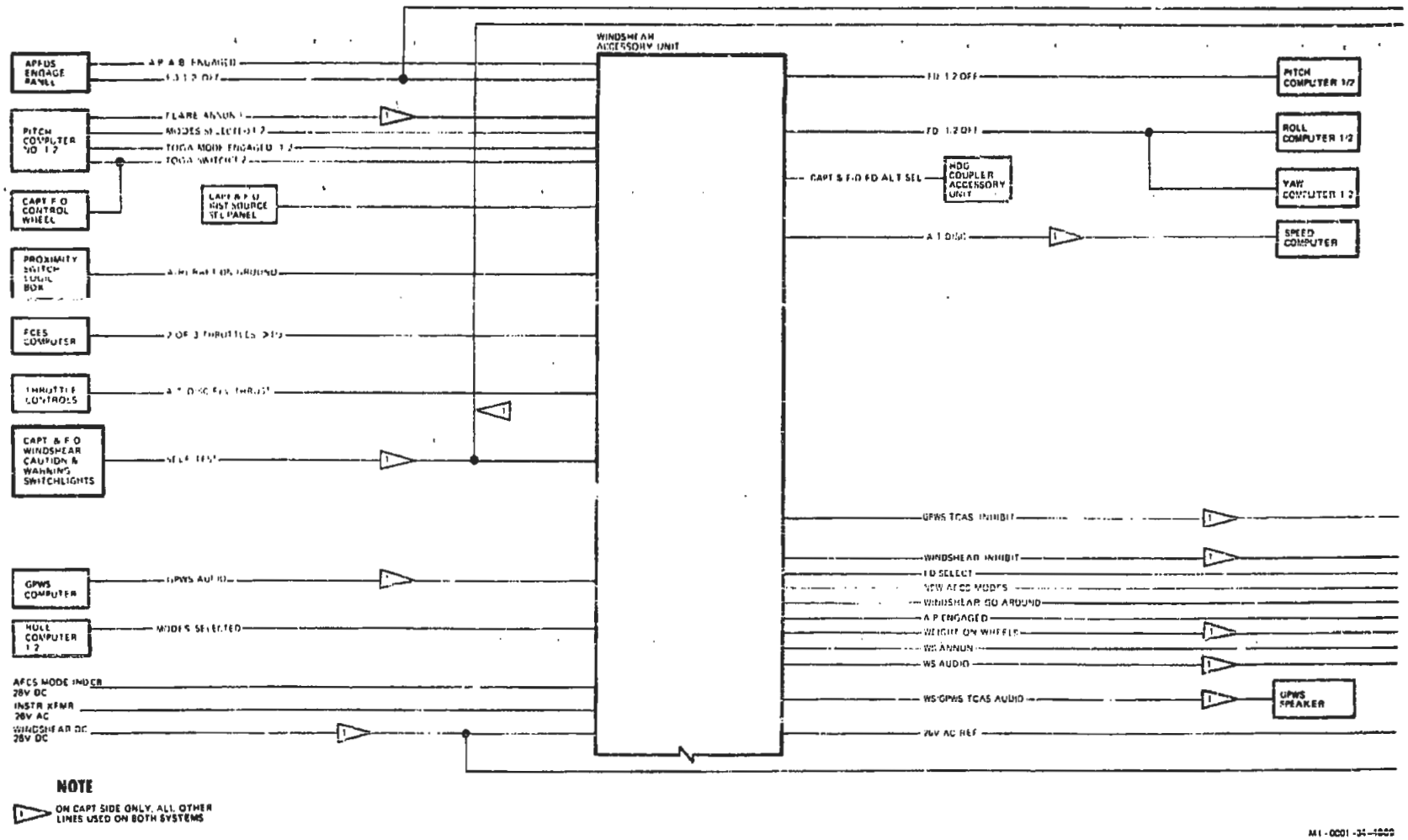
The airspeed on takeoff/go-around is greater than 60 knots.

The warning will be inhibited after the airplane has climbed more than 1500 feet or after 3 minutes from an airborne go-around initiation.

Approach - The amber or red flashing light will illuminate when all of the following conditions are present:

Windshear condition is detected.

Airspeed is less than 170 knots.



NOTE

1 ON CAPT SIDE ONLY, ALL OTHER LINES USED ON BOTH SYSTEMS

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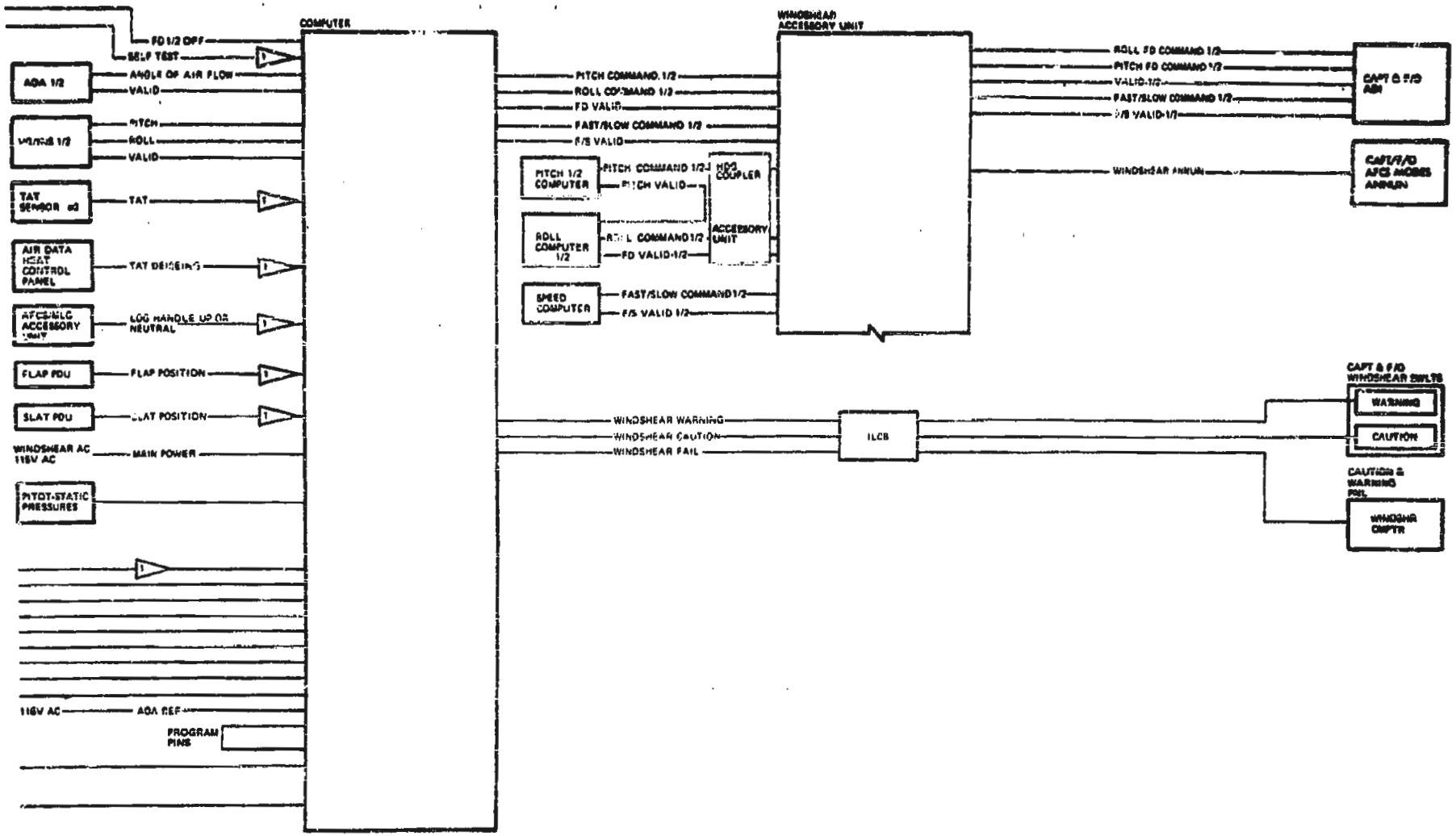
R Windshear System Block Diagram
R Figure 4 (Sheet 1)

EFFECTIVITY: AIRCRAFT WITH SB34-178 AND SB34-179

001B



R Windshear System Block Diagram
R Figure 4 (Sheet 2)

EFFECTIVITY: AIRCRAFT WITH SB34-178 AND SB34-179

001B

Flaps are 30 degrees or greater or the landing gear is down.

Both caution/warning lights will be inhibited after touchdown or after the flare maneuver has commenced at 50 feet altitude during automatic landings.

E. Windshear Aural Warnings

The windshear aural warnings will be activated under the same conditions as the red warning light as follows:

"WINDSHEAR, WINDSHEAR, WINDSHEAR" aural message coincident with the red visual warning light, repeated after 30 seconds if red visual warning is still present (Ref. Fig. 5).

"DISCONNECT AUTOPILOT, DISCONNECT AUTOPILOT" aural message immediately after the "WINDSHEAR..." aural message if autopilot is not disconnected.

The aural warnings are broadcast through the existing Ground Proximity Warning System (GPWS) loudspeaker. Since a severe windshear encounter can drive the aircraft close to the ground, a GPWS warning could also occur (Ref. 34-45-00). To prevent simultaneous aural warnings which could be confusing to a flight crew in a high stress situation, the windshear aural warning will have priority over GPWS and TCAS (Ref. 34-53-00) warnings during windshear encounters.

F. Windshear Escape Guidance

A typical heavy L-1011 with all engines operating at maximum rated thrust can accelerate at about 3 or 4 knots per second in level flight from takeoff or landing speeds. The normal margin between these speeds and the stall warning (stick shaker) speed is about 15 to 20 knots. Thus, a sustained decreasing performance windshear exceeding 3 to 4 knots per second will require a reduction of the stall margin, or a loss of altitude, or both in order to combat the shear. A tradeoff of these parameters is performed by the windshear computer in order to provide optimum escape guidance (Ref. Fig. 6).

When activated, the guidance control law initially attempts to guide the pilot to fly a 1.5 degree positive (ascending) flight path, using a maximum angle of attack corresponding to about 2 degrees short of stick shaker. If the aircraft performance continues to decrease, the positive flight path is then traded at the same angle of attack until level flight can just be maintained. A further performance decrease, causing a negative flight path, results in a

transition to a higher angle of attack, equivalent to intermittent stick shaker. This is held until the windshear eases and the aircraft can begin accelerating with respect to the air mass. On recovery, the aircraft is guided back to a 1.5 degree positive flight path. In an actual encounter, the transition sequences would cycle back and forth with the wind variations. The guidance control law also includes attitude limits which, although second order in nature, serve to enhance overall performance.

Windshear escape guidance is provided on both pilots ADIs when all four of the following conditions exist:

A windshear red warning is present; and

The Autopilot is not engaged; and

The aircraft is not on the ground; and

Any of the following:

APFDS takeoff/go-around mode engaged, or

Go-Around switch on either pilots control wheel is depressed, or

Two of the throttles set to greater than normal approach thrust.

NOTE: Throttle initiation of windshear escape guidance is provided only upon first engagement of windshear guidance in any one windshear event. This is to prevent nuisance pop-ups, should the pilot wish to deselect windshear guidance while the red windshear warning is still active.

The engagement of windshear guidance will drop any AFCS mode previously engaged and will disconnect the autothrottle if previously engaged. The windshear guidance mode will be annunciated on both pilots' AFCS modes indicators by the display of the legend WINDSHR; any previously displayed legend will be cleared. The mode will remain latched until the conditions for disengagement are met. If the aircraft flies out of the windshear condition and the red warning is extinguished, a recovery guidance profile (airspeed recovery and wings level) will be provided by the windshear computer until windshear guidance is disengaged.

After engagement, windshear escape guidance may be deselected from either pilot's flight director by cycling his flight director switch to the off position (on to off or

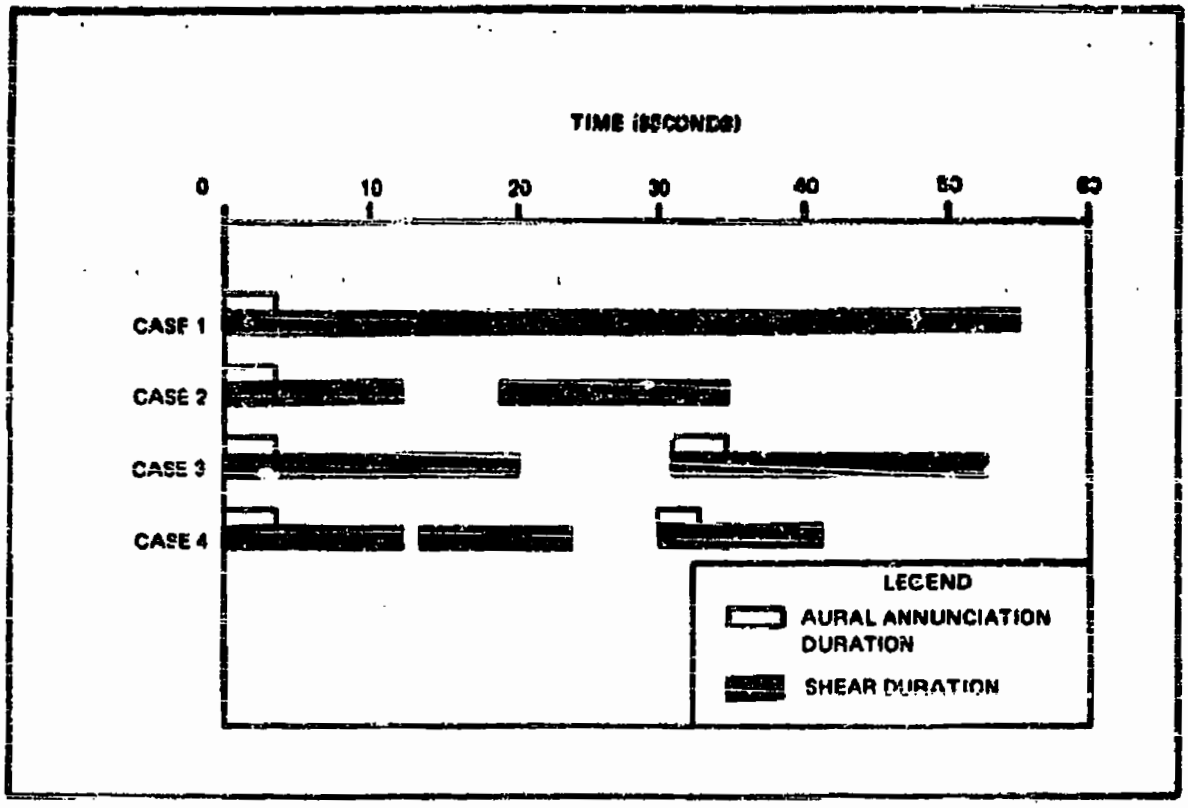
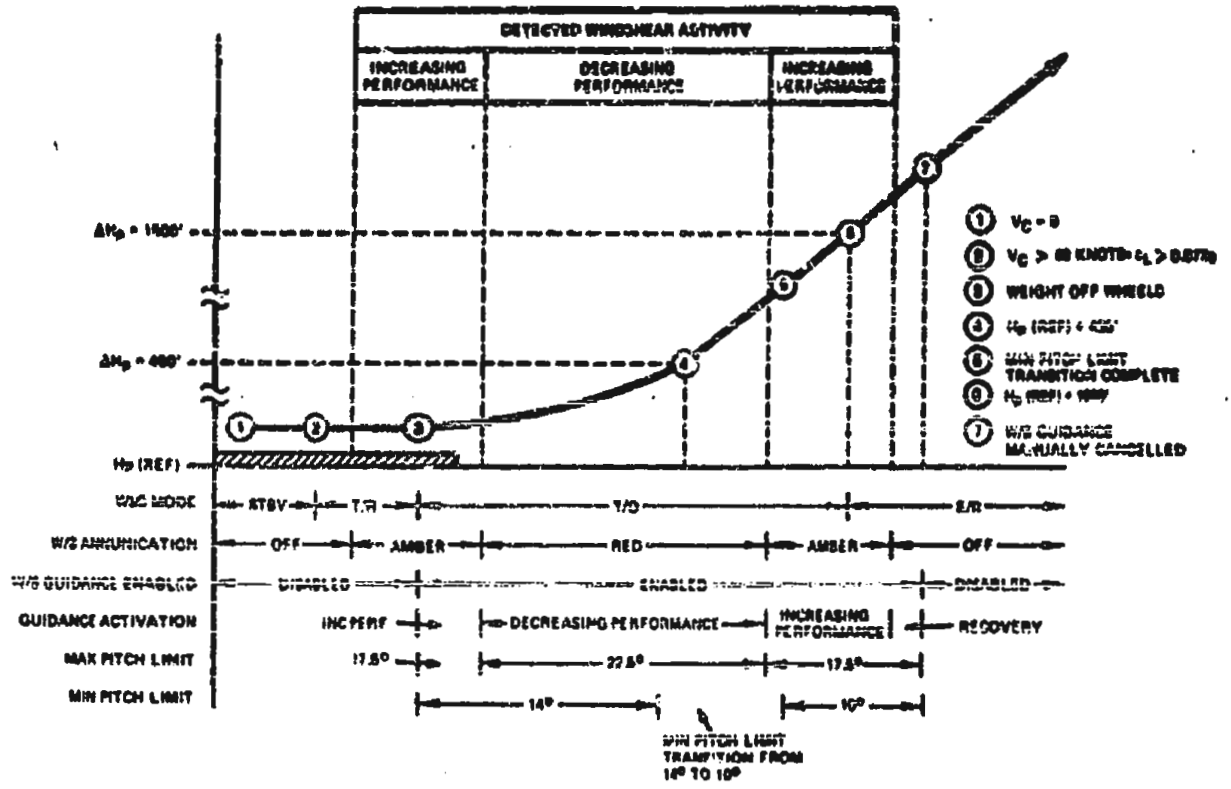
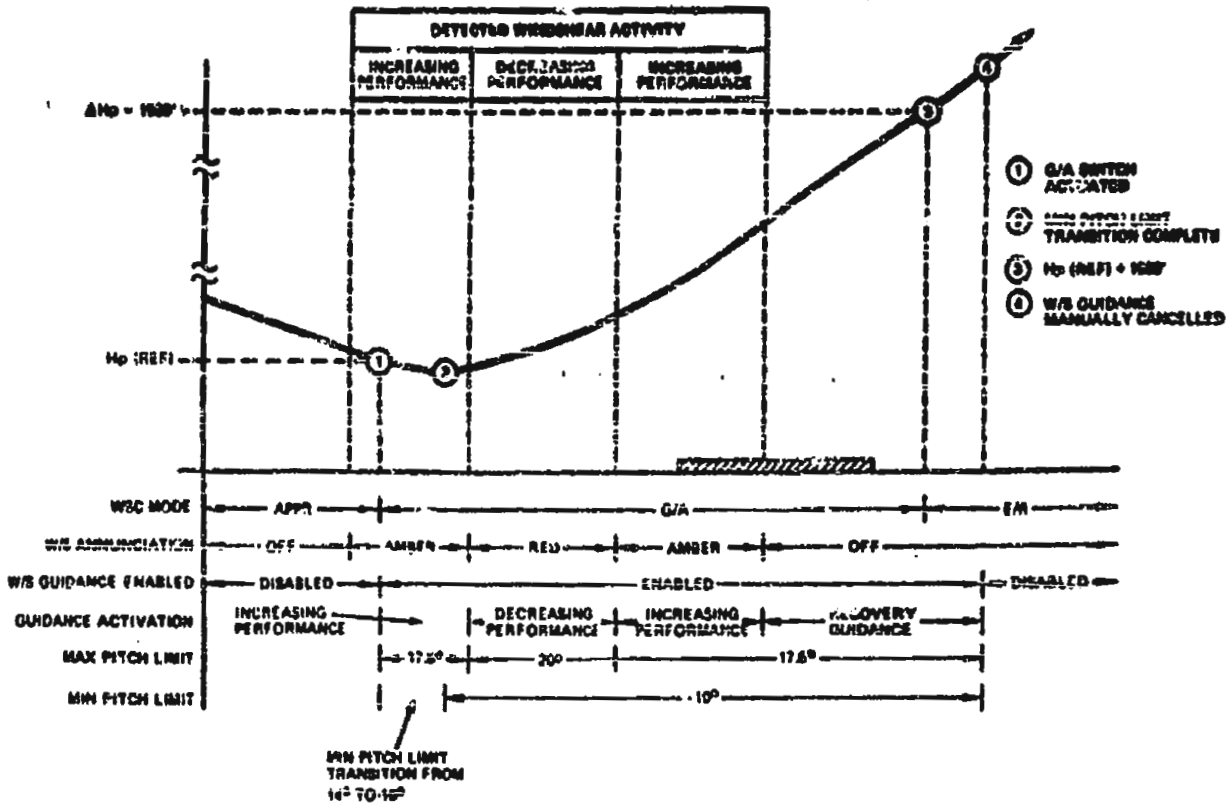


Figure 5 Aural Warning Annunciation

In Case 1, a decreasing windshear of extended duration is encountered resulting in a single-cycle broadcast of the aural warning message. A multiple windshear encounter within a 30-second period is illustrated in Case 2. Once again, the result is a single-cycle aural warning message broadcast. Cases 3 and 4 result in a double-cycle broadcast due to the 30-second (or greater) elapsed time period between the annunication of the primary and subsequent windshears.



Windshear Guidance (Takeoff)
Figure 6 (Sheet 1)



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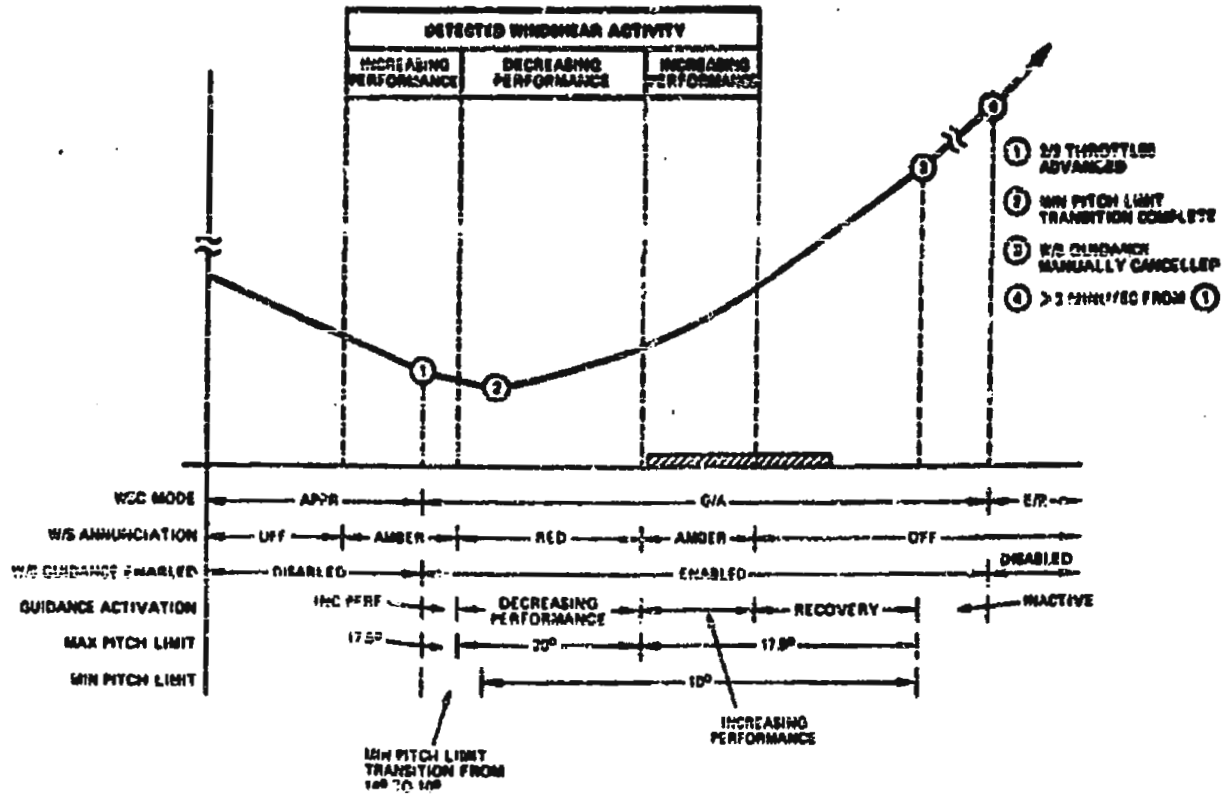
Windshear Guidance (Go-Around)
Figure 6 (Sheet 2)



Windshear Guidance (2/3 Throttles Advance)
Figure 6 (Sheet 3)

off to on to off). If the other pilot has not deselected guidance, the windshear guidance mode will remain set and the fast/slow indicator on the deselected ADI will continue to show windshear related information. Windshear guidance to the deselected ADI can be restored by turning the flight director switch on.

Windshear escape guidance will be removed from both ADIs and the windshear mode disengaged when any of the following occurs:

An autopilot is engaged; or

The aircraft is on the ground; or

Both pilots flight director switches are cycled to the off position (on-off or off-on-off); or

The windshear red warning is extinguished and the go-around switch on either pilot's control wheel is depressed; or

The windshear red warning is extinguished, a flight director switch is on and a new AFCS mode is selected on the APPDS glareshield panel.

Disengagement of the windshear guidance mode will remove the "WINDSHR" message from the AFCS Modes indicators and will allow normal AFCS operation. If the red windshear warning is still present, re-engagement of the windshear guidance mode is possible only by depressing the go-around switch on a pilot's control wheel (see above note on throttle initiation of the windshear escape guidance mode).

G. Failure Monitoring

As previously mentioned, a major windshear encounter is a very rare event in normal airline operations. Consequently, the rate at which the Windshear System will be used for actual windshear escapes is expected to be very low. It is thus not possible for the pilots to regularly evaluate and squawk the performance of the system in service as they do for other systems. Nevertheless, as with any emergency equipment, the Windshear System must always be maintained in a high degree of readiness for an encounter, whenever it may occur.

The Windshear System is unlike most emergency equipment, however, in that it is an avionic system with a finite failure rate and interfaces with several existing L-1011 avionic systems with known failure rates. In order to maintain a high level of system availability in such an

environment, it is necessary to provide a comprehensive failure monitoring capability, so that any failures can be quickly diagnosed and defective units replaced.

The Windshear System detects failures utilizing two methods:

Continuous built-in test; and

Pilot initiated self test.

The continuous built-in test (CBIT), as its name implies, is a continuously running check of all internal windshear computer functions, and all inputs and most outputs for the external interfaces. If CBIT detects, in flight, a failure of such significance as to render windshear detection or guidance inoperative, the "WINDSHR CMPTR" fail light on the aircraft Caution and Warning Panel will illuminate. A lesser failure will not annunciate until the aircraft has landed and the airspeed has fallen below 30 knots.

The pilot-initiated self test is primarily a pre-flight test to check the system outputs as seen and heard by the pilots. Since all windshear computer outputs, except for the lights, are routed via the windshear accessory unit, the self test also checks the functions of this unit. The self test is activated by momentarily depressing the windshear switchlight when the aircraft is on the ground and its airspeed is below 30 knots. An 8 second self test routine is performed, in which:

All warning lamps are illuminated in amber/red sequence.

The fail light is illuminated.

A "WINDSHEAR" voice message is broadcast through the cockpit loudspeaker at a subdued level.

If guidance has been initiated via the throttle levers or TO/GA switch, the AFCS MODES indicators display "WINDSHR" and the flight director and fast/slow pointers on both ADIs move in a prescribed manner over their range of travel.

If no failure has been detected during the self test or a previously annunciated failure has been cleared, the system fail light will extinguish at the completion of the test. If any failure is still present after the self test, the fail light will remain illuminated. A further test is then necessary to determine the nature of the failure.

A prolonged (greater than two seconds) push of the system test switch activates the second test. If the self-test switch is pressed again within 5 seconds after the completion of self test the failures are broadcast aurally via the cockpit speaker at reduced volume. The aural status messages are in synthesized voice format and annunciate either a computer failure or particular interface failure(s). Such information should greatly assist the line maintenance technician in trouble-shooting the system. At the completion of this second level test, the fail light will extinguish if the failure does not render windshear detection or guidance inoperative; otherwise the light will remain on until the problem is rectified.

As an additional maintenance aid, the windshear computer can store, in its memory, failure data for a maximum of 96 flights. Up to 16 failures per flight can be logged. When the memory is full the oldest data is overwritten with the latest data. In this manner a considerable history of system failures is always available. The data may be downloaded to a data loader/recorder and thence to a ground replay station, if the data is required for later analysis.

WINDSHEAR WARNING AND GUIDANCE SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If flight crew reports a trouble using a FIRM fault code, the code can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

CR Refer to Pages 139/140 through 151/152 for troubleshooting using
CR ARNIC 429 Bus tester.* Also refer to TWA Illustrated Tool and
CR Equipment Manual 34-19-01, Pages 1 through 13 for additional
CR information on ARNIC 429 Bus Tester.

CR * Stead Aviation WST-200 Windshear Tester (TWA Stk. Nbr.
CR 90034), Windshear Test Cable (attached).

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER, WINDSHEAR	1	FESC/112AB	34-19-01
LIGHT, WINDSHEAR FAIL	1	FLT STA/PILOTS CTR PNL	20-33-04
SPEAKER, GPWS	1	FLT STA/CAPT OVHD	34-45-03
SWITCH LIGHT, WINDSHEAR CAUTION AND WARNING	2	FLT STA/CAPT & F/O INSTR PNL	20-33-02
UNIT, WINDSHEAR ACCESSORY	1	FESC/112AB	34-19-02

*SEE WM EQUIPMENT LIST

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Component Location Index
Figure 101

R EFFECTIVITY: ALL
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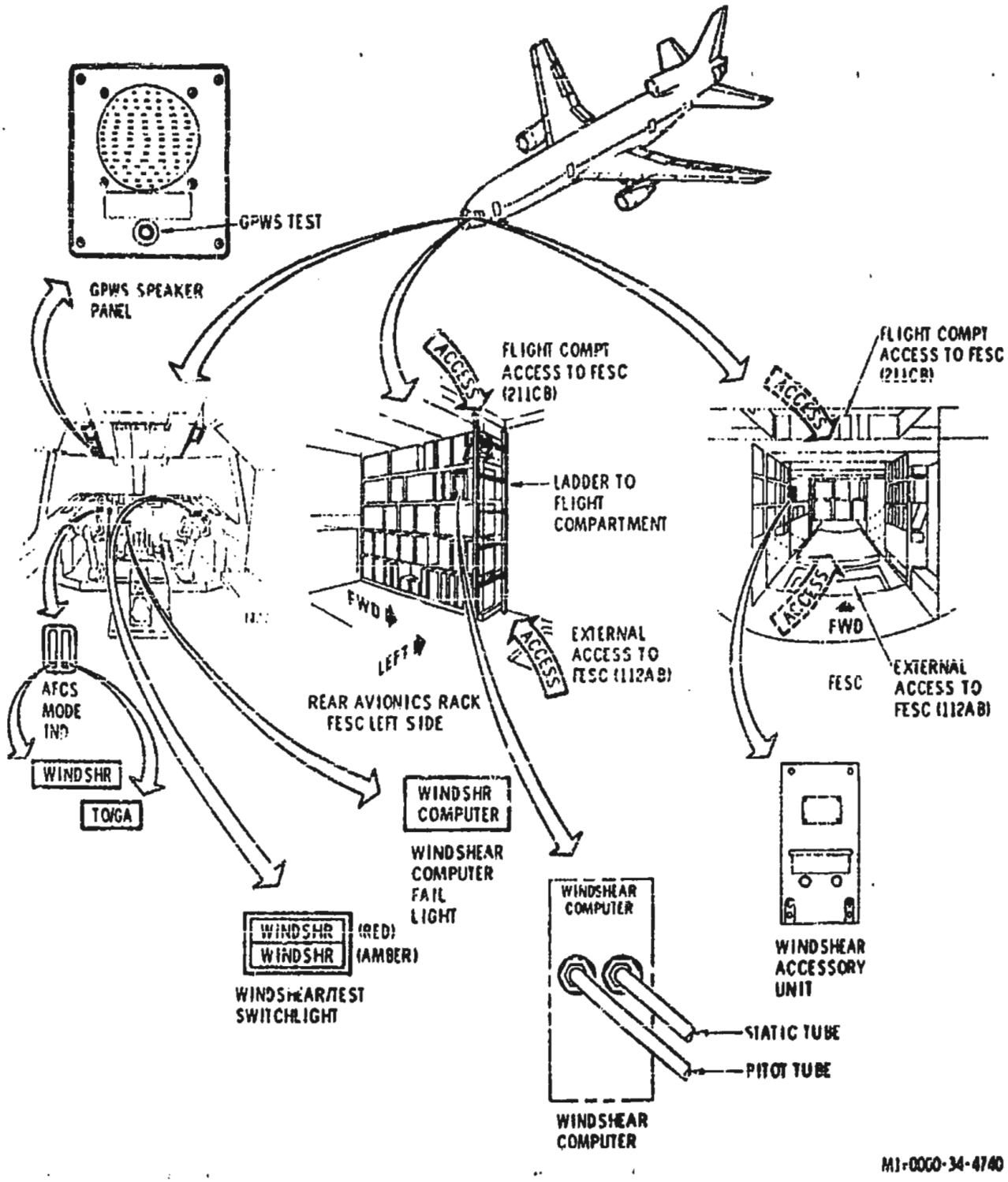

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R Component Location Diagram
R Figure 102

R EFFECTIVITY: ALL
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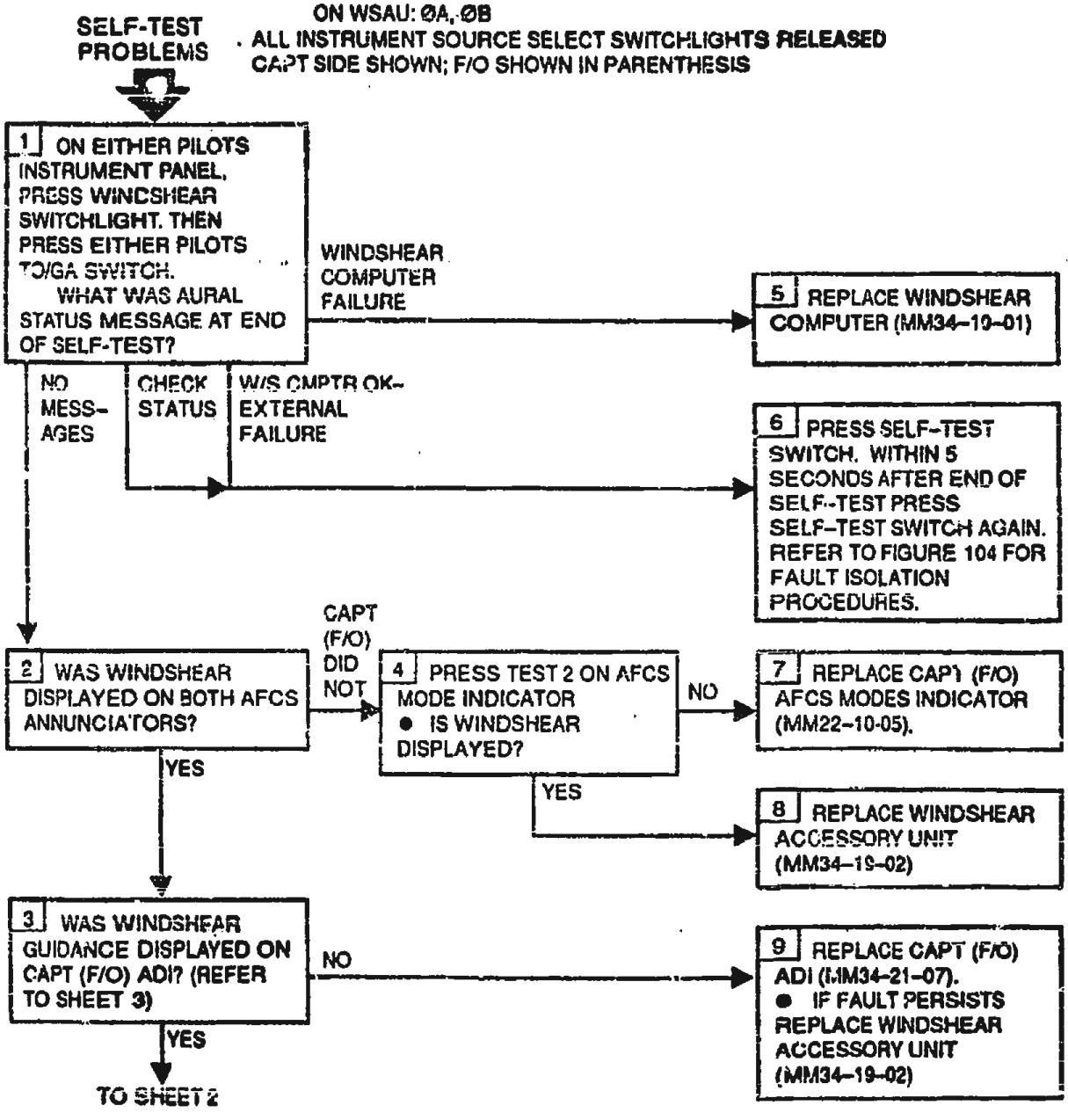
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: (MM21-25-00)
CB'S: 1A19, 1A20, 1D9, 1D27 IN FESC
ON WSAU: ØA, ØB
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
CAPT SIDE SHOWN; F/O SHOWN IN PARENTHESIS


SELF-TEST PROBLEMS
1 ON EITHER PILOTS INSTRUMENT PANEL, PRESS WINDSHEAR SWITCHLIGHT. THEN PRESS EITHER PILOTS TO/GA SWITCH.
WHAT WAS AURAL STATUS MESSAGE AT END OF SELF-TEST?
WINDSHEAR COMPUTER FAILURE
5 REPLACE WINDSHEAR COMPUTER (MM34-10-01)
NO MESS-AGES
CHECK STATUS
W/S CMPTR OK-EXTERNAL FAILURE
6 PRESS SELF-TEST SWITCH. WITHIN 5 SECONDS AFTER END OF SELF-TEST PRESS SELF-TEST SWITCH AGAIN. REFER TO FIGURE 104 FOR FAULT ISOLATION PROCEDURES.
2 WAS WINDSHEAR DISPLAYED ON BOTH AFCS ANNUNCIATORS?
CAPT (F/O) DID NOT
4 PRESS TEST 2 ON AFCS MODE INDICATOR
• IS WINDSHEAR DISPLAYED?
NO
7 REPLACE CAPT (F/O) AFCS MODES INDICATOR (MM22-10-05).
YES
8 REPLACE WINDSHEAR ACCESSORY UNIT (MM34-19-02)
YES
3 WAS WINDSHEAR GUIDANCE DISPLAYED ON CAPT (F/O) ADI? (REFER TO SHEET 3)
NO
9 REPLACE CAPT (F/O) ADI (MM34-21-07).
• IF FAULT PERSISTS REPLACE WINDSHEAR ACCESSORY UNIT (MM34-19-02)
YES
TO SHEET 2

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R
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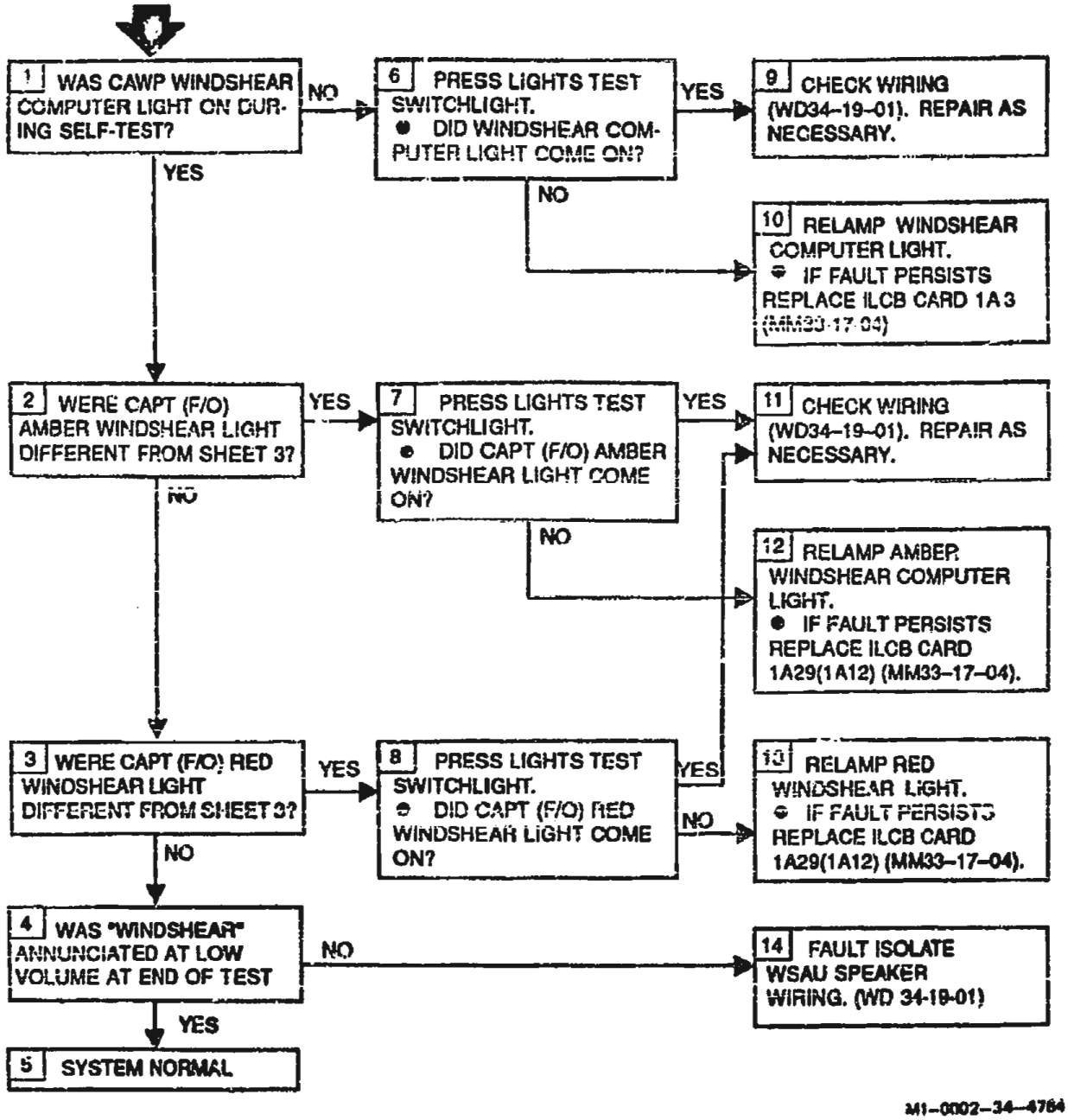
Self-Test Problems
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: (MM21-25-00)
CB'S: 1A19, 1A20, 1D9, 1D27 IN FESC
ON WSAU: ØA, ØB
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
CAPT SIDE SHOWN; F/O SHOWN IN PARENTHESIS

(FROM SHEET 1)


1 WAS CAWP WINDSHEAR COMPUTER LIGHT ON DURING SELF-TEST?
NO
YES
6 PRESS LIGHTS TEST SWITCHLIGHT.
• DID WINDSHEAR COMPUTER LIGHT COME ON?
YES
NO
9 CHECK WIRING (WD34-19-01). REPAIR AS NECESSARY.
10 RELAMP WINDSHEAR COMPUTER LIGHT.
• IF FAULT PERSISTS REPLACE ILCB CARD 1A3 (MM33-17-04)
2 WERE CAPT (F/O) AMBER WINDSHEAR LIGHT DIFFERENT FROM SHEET 3?
YES
NO
7 PRESS LIGHTS TEST SWITCHLIGHT.
• DID CAPT (F/O) AMBER WINDSHEAR LIGHT COME ON?
YES
NO
11 CHECK WIRING (WD34-19-01). REPAIR AS NECESSARY.
12 RELAMP AMBER WINDSHEAR COMPUTER LIGHT.
• IF FAULT PERSISTS REPLACE ILCB CARD 1A29(1A12) (MM33-17-04).
3 WERE CAPT (F/O) RED WINDSHEAR LIGHT DIFFERENT FROM SHEET 3?
YES
NO
8 PRESS LIGHTS TEST SWITCHLIGHT.
• DID CAPT (F/O) RED WINDSHEAR LIGHT COME ON?
YES
NO
13 RELAMP RED WINDSHEAR LIGHT.
• IF FAULT PERSISTS REPLACE ILCB CARD 1A29(1A12) (MM33-17-04).
4 WAS "WINDSHEAR" ANNUNCIATED AT LOW VOLUME AT END OF TEST
NO
YES
14 FAULT ISOLATE WSAU SPEAKER WIRING. (WD 34-19-01)
5 SYSTEM NORMAL

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R Self-Test Problems
R Figure 103 (Sheet 2)

EFFECTIVITY: ALL

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INDICATIONS	TIME IN SECONDS			
	0–1	1–4	4–7	7–8
BOTH AMBER WINDSHEAR CAUTION LTS FLASH	FLASHING (2)		OFF	
BOTH RED WINDSHEAR CAUTION LTS FLASH	OFF		FLASHING (2)(3)	
WINDSHEAR COMPUTER C&W LT	ON			
AURAL ANNUNCIATION	SILENT		WINDSHEAR ANNUNCIATED AT A LOW VOLUME	
BOTH F/D PITCH COMMAND (1)(4)	CENTERED	UP HALF SCALE	DOWN HALF SCALE	CENTERED
BOTH F/D ROLL COMMAND (1)(4)	CENTERED	RT HALF SCALE	LT HALF SCALE	CENTERED
BOTH F/S COMMAND (1)(4)	CENTERED	FAST FULL SCALE	SLOW FULL SCALE	CENTERED
BOTH F/D FLAG	OUT OF VIEW			IN VIEW
BOTH F/S FLAG	OUT OF VIEW			IN VIEW

(1) EITHER TO/GA SWITCH MUST BE PRESSED TO GET THESE RESULTS.

(2) FLASHING STOPS 1 SECOND AFTER PRESSING TO/GA SWITCH.

(3) FLASHING STOPS 1 SECOND AFTER COMPLETION OF SELF-TEST.

(4) THE PITCH COMMAND, ROLL COMMAND, AND F/S COMMAND SHALL SNAP TO THE CENTER POSITION AND THEN SMOOTHLY SWEEP AT A CONSTANT RATE THROUGH THE SCALE POSITIONS.

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R Self-Test Problems
R Figure 103 (Sheet 3)

EFFECTIVITY: ALL

001B

FAILURE ANNUNCIATION MESSAGE	FAULT PROCEDURE
WINDSHEAR COMPUTER FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-01)
SYNCHRO REFERENCE INPUT FAILURE	REPLACE WINDSHEAR ACCESSORY UNIT (MM34-19-02) IF FAULT PERSISTS CHECK WIRING (WD34-19-01) AS FOLLOWS: PITCH/ROLL 1 REF 3419-J1A-13,-14 FLARE REF 3419-J1A-17,-18 AOA 1 REF 3419-J1A-15,-16 PITCH/ROLL 2 REF 3419-J1B-13,-14 AOA 2 REF 3419-J1B-15,-16
TAT INPUT FAILURE	REPLACE NO.2 (RH) TOTAL AIR TEMPERATURE SENSOR (REF. MM34-14-06)
PITCH ONE INPUT FAILURE ROLL ONE INPUT FAILURE	REPLACE VG/INS NO. 1 ⚠1
PITCH TWO INPUT FAILURE ROLL TWO INPUT FAILURE	REPLACE VG/INS NO. 2 ⚠1
PITCH INPUT COMPARISON FAILURE ROLL INPUT COMPARSION FAILURE	REPLACE BOTH VG/INS NO. 1 AND NO. 2 ⚠1 IF FAULT PERSISTS REPLACE WINDSHEAR COMPUTER (MM34-19-01)
"A-O-A" ONE INPUT FAILURE	REPLACE LEFT ANGLE-OF-ATTACK (MM22-31-06)
"A-O-A" TWO INPUT FAILURE	REPLACE RIGHT ANGLE-OF-ATTACK (MM22-31-06)
"A-O-A" INPUT COMPARISON FAILURE	REPLACE BOTH LEFT AND RIGHT ANGLE-OF-ATTACK (MM22-31-06). IF FAULT PERSISTS REPLACE WINDSHEAR COMPUTER (MM34-19-01)
FLAP INPUT FAILURE	REPLACE FLAP POWER DRIVE UNIT SWITCHBOX NO. 1 (MM27-51-12)
FAST SLOW ONE FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-02)
FLIGHT DIRECTOR ONE FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-02)
FAST SLOW TWO FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-02)
FLIGHT DIRECTOR TWO FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-02)

NOTE ⚠1 VG EQUIPED AIRCRAFT (MM34-21-04)
INS EQUIPED AIRCRAFT (MM34-43-03)

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R Aural Failure Message
R Figure 104 (Sheet 1)

R EFFECTIVITY: ALL
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FAILURE ANNUNCIATION MESSAGE	FAULT PROCEDURE
DISCRETE OUTPUT FAILURE	REPLACE WINDSHEAR COMPUTER (MM34-19-01)
"D-C" POWER FAILURE	CHECK AND REPAIR WIRING (WD34-19-01) AS NECESSARY
DISCRETE INPUT FAILURE	REPLACE WINDSHEAR ACCESSORY UNIT (MM34-19-02) FOR FOLLOWING FAULTS. IF FAULT PERSISTS CHECK WIRING (WD34-19-01) AS FOLLOWS: NEW AFCS MODES 1 3419-J1A-70 NEW AFCS MODES 2 3419-J1B-70 WOW 3419-J1A-33 W/S ANNUN INHIBIT 3419-J1B-67 WSGA A 3419-J1A-03 WSGA B 3419-J1B-28 A/P A 3419-J1A-85 A/P B 3419-J1A-85 IF FAULT PERSISTS REPLACE WINDSHEAR COMPUTER (MM34-19-01) REPLACE WINDSHEAR COMPUTER (MM34-19-02) FOR FOLLOWING FAULTS. IF FAULT PERSISTS CHECK WIRING (WD34-19-01) AS FOLLOWS: F/D A 3419-J1A-47 F/D B 3419-J1B-42 LDG LVR 3419-J1A-34 SELF-TEST 3419-J1A-46 SLATS 3419-J1A-90 TAT DEICE 3419-J1B-49

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R Aural Failure Messages
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
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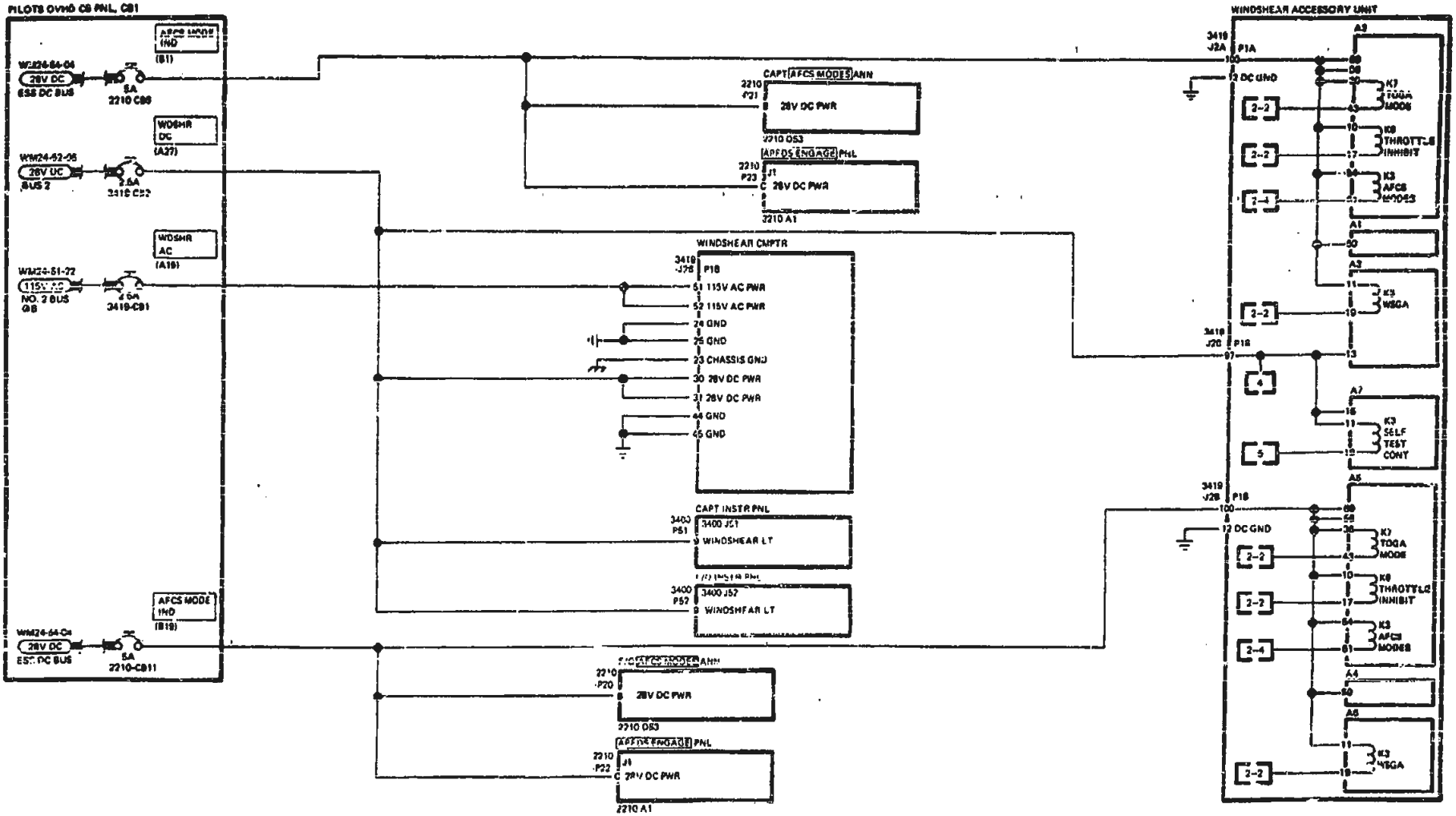

R Windshear System - Power Distribution Schematic
R SCHEM 1

R EFFECTIVITY: ALL
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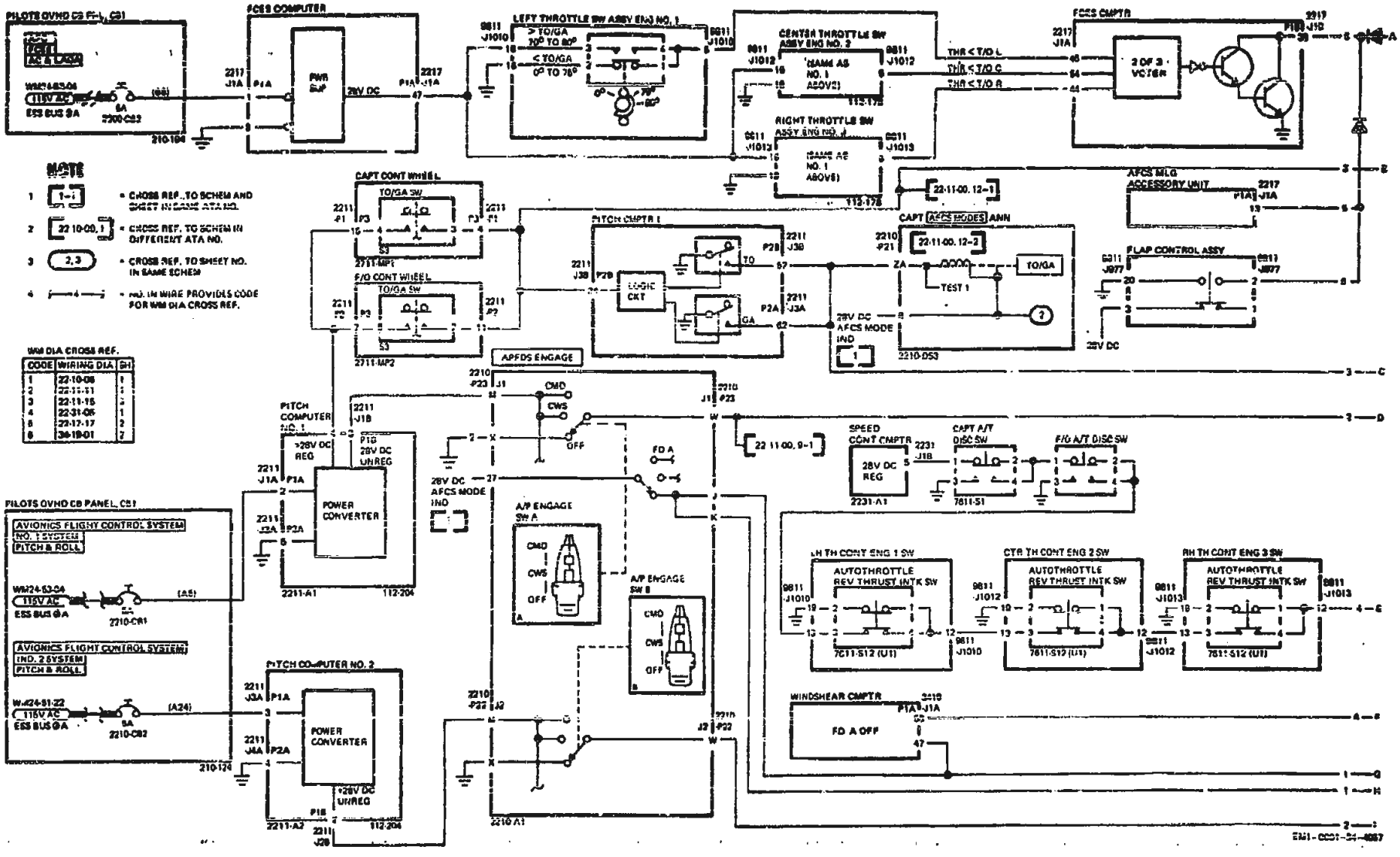

R Windshear System - (Capt) Signal Flow Schematic
R SCHEM 2 (Sheet 1)

R EFFECTIVITY: ALL
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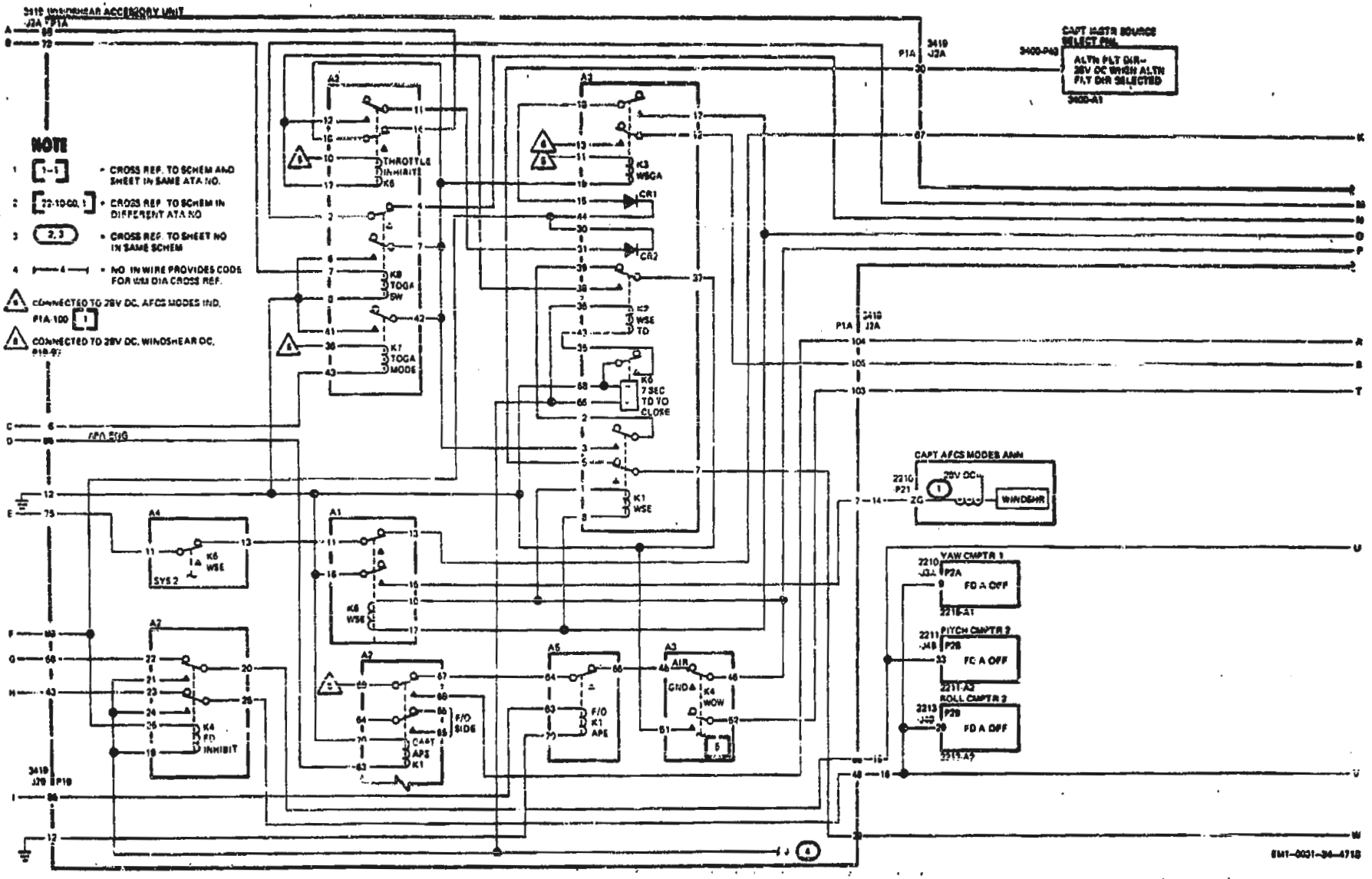

R Windshear System - (Capt) Signal Flow Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL

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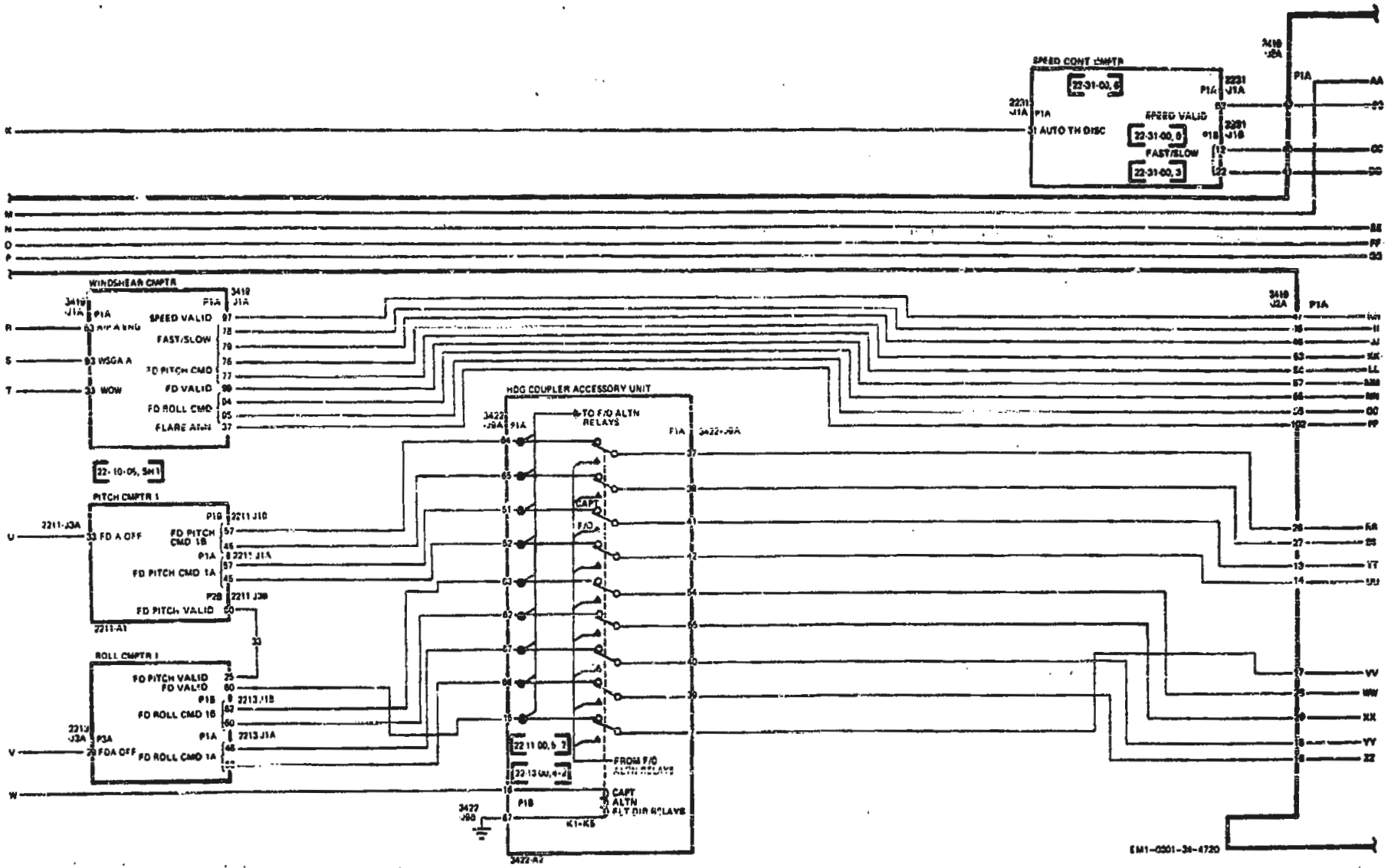

R Windshear System - (Capt) Signal Flow Schematic
R SCHEM 2 (Sheet 3)

EFFECTIVITY: ALL

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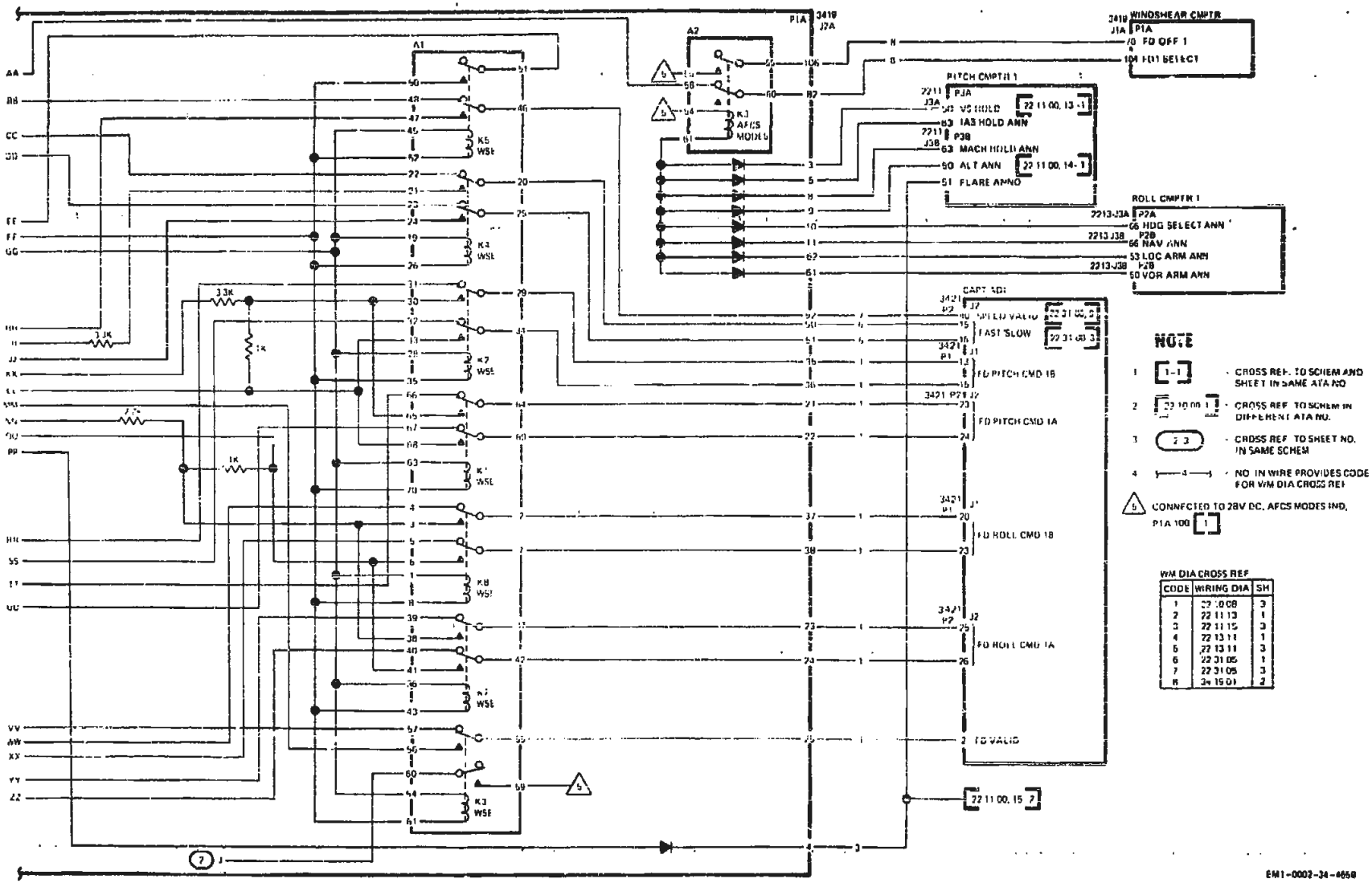
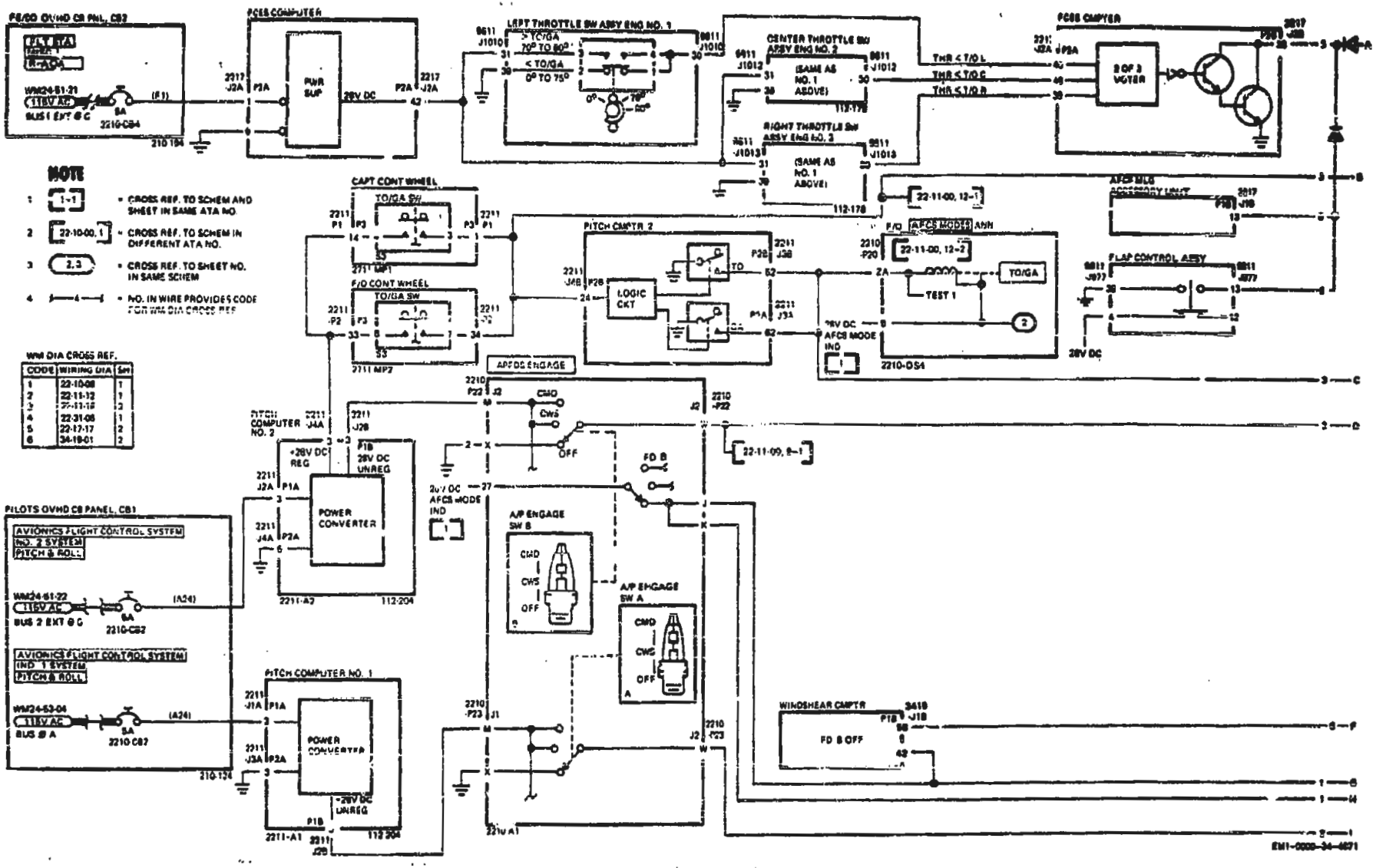

WINDSHEAR CMPTR
FD OFF 1
FD1 SELECT
PITCH CMPTR 1
VS HOLD
IAS HOLD ANN
MACH HOLD ANN
ALT ANN
FLARE ANNO
ROLL CMPTR 1
HDG SELECT ANN
NAV ANN
LOC ARM ANN
VOR ARM ANN
CAPT ADI
SPEED VALID
FAST SLOW
FD PITCH CMD 1B
FD PITCH CMD 1A
FD ROLL CMD 1B
FD ROLL CMD 1A
FD VALID
AFCS MODES
K1
K2 WSE
K3 WSE
K4 WSE
K5 WSE
K6 WSE
K7 WSE
K8 WSE
33K
3.3K
1K
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO
2 [22 10 00 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5 CONNECTED TO 28V DC, AFCS MODES IND, P1A 100 [1]
WM DIA CROSS REF
CODE | WIRING DIA | SH
1 | 22 10 08 | 3
2 | 22 11 13 | 1
3 | 22 11 15 | 3
4 | 22 13 11 | 1
5 | 22 13 11 | 3
6 | 22 31 05 | 1
7 | 22 31 05 | 3
8 | 34 19 01 | 2
EM1-0003-34-4650

R Windshear System - (Capt) Signal Flow Schematic
R SCHEM 2 (Sheet 4)

EFFECTIVITY: ALL

001B



R Windshear System - (F/O) Signal Flow Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

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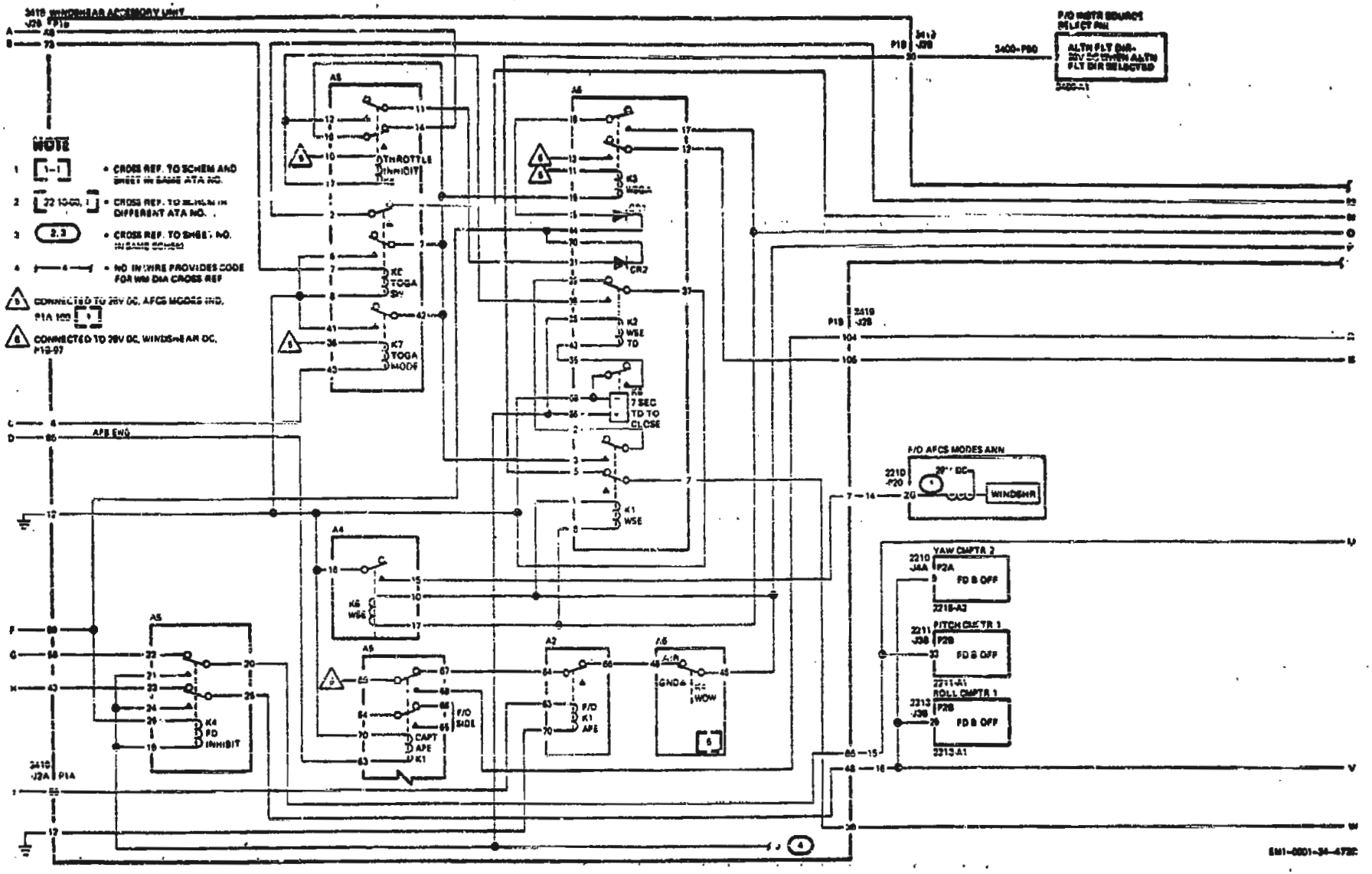
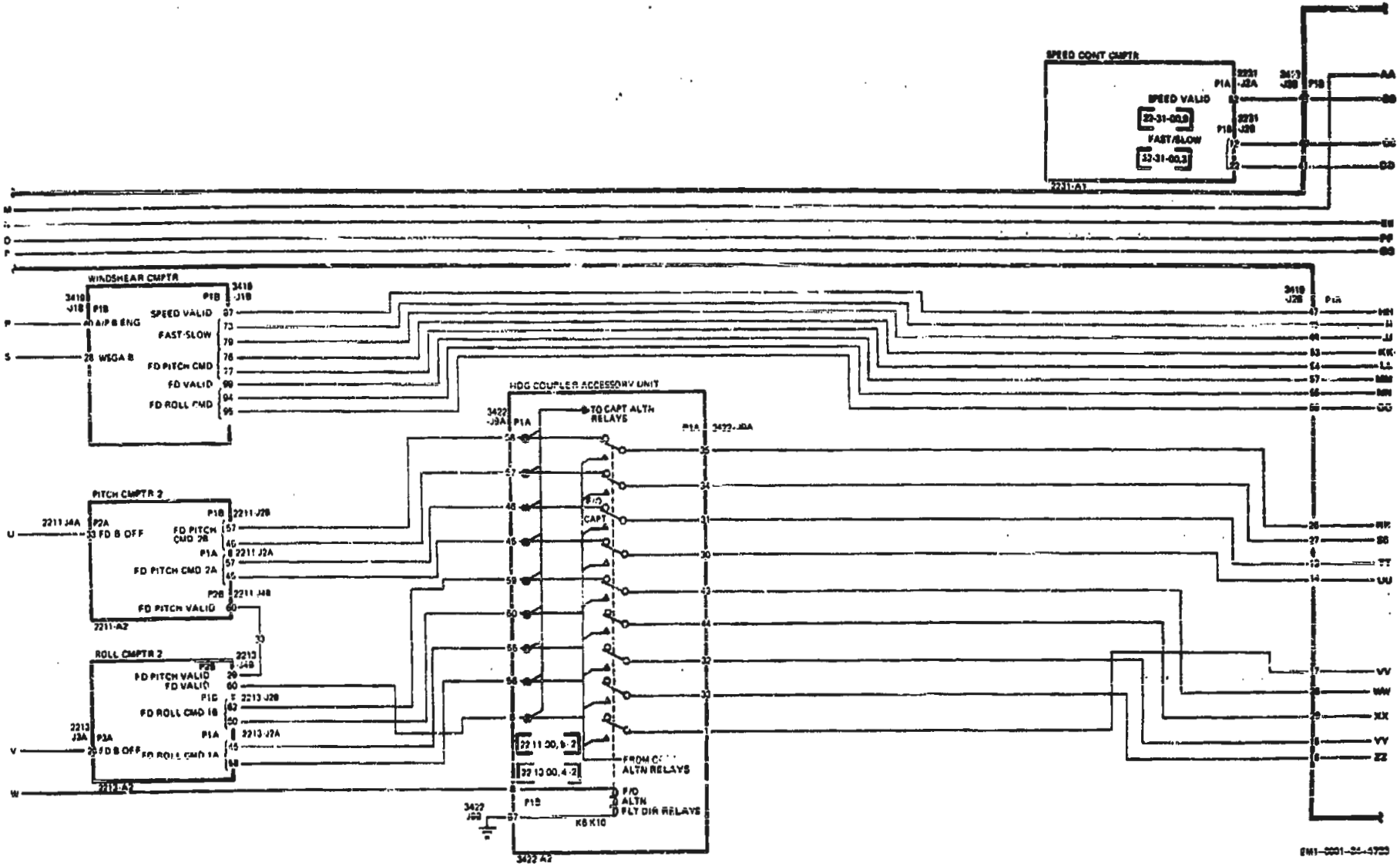


R Windshear System - (F/O) Signal Flow Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL

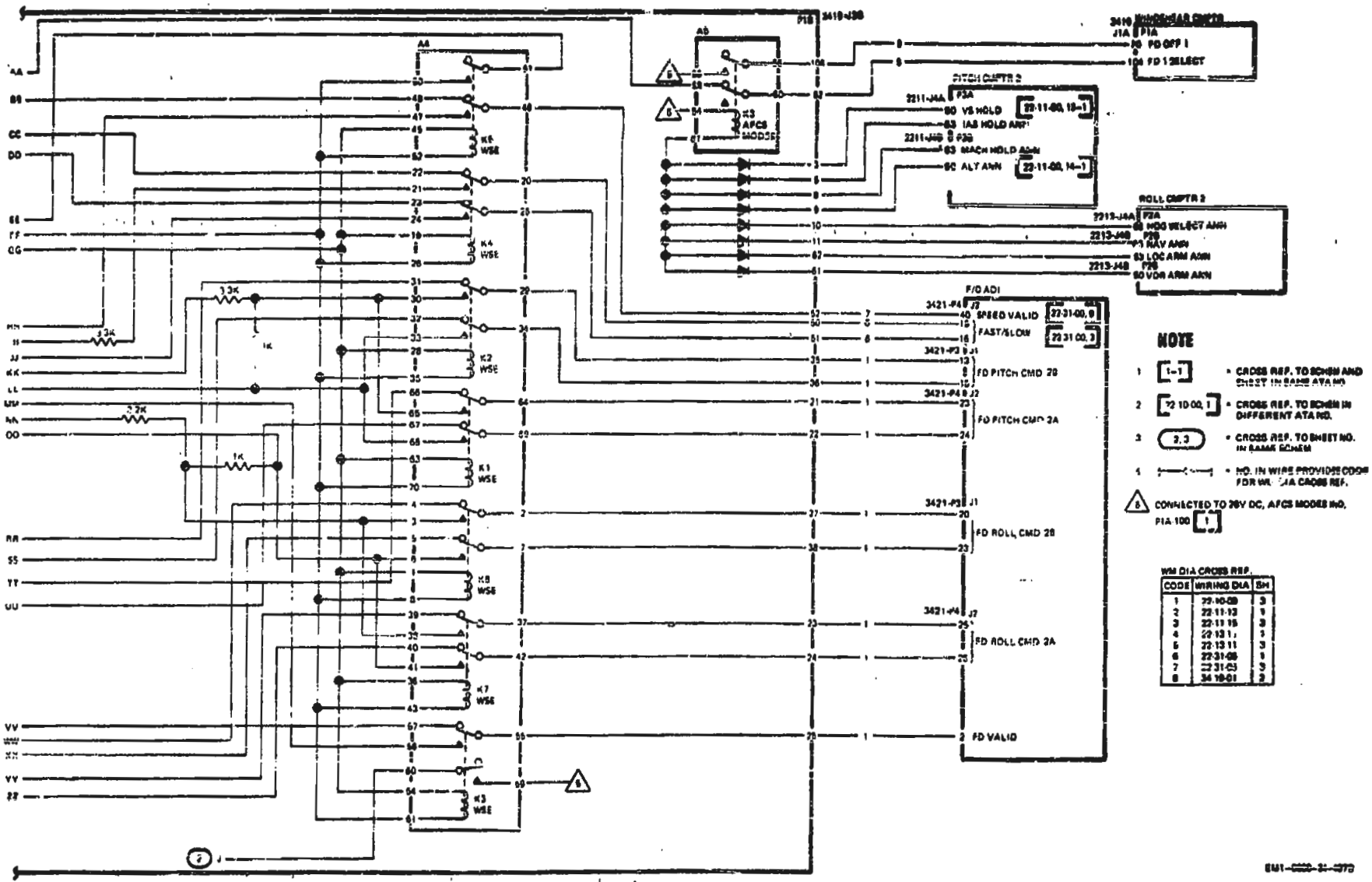
001B



R Windshear System - (F/O) Signal Flow Schematic
R SCHEM 2 (Sheet 3)

EFFECTIVITY: ALL

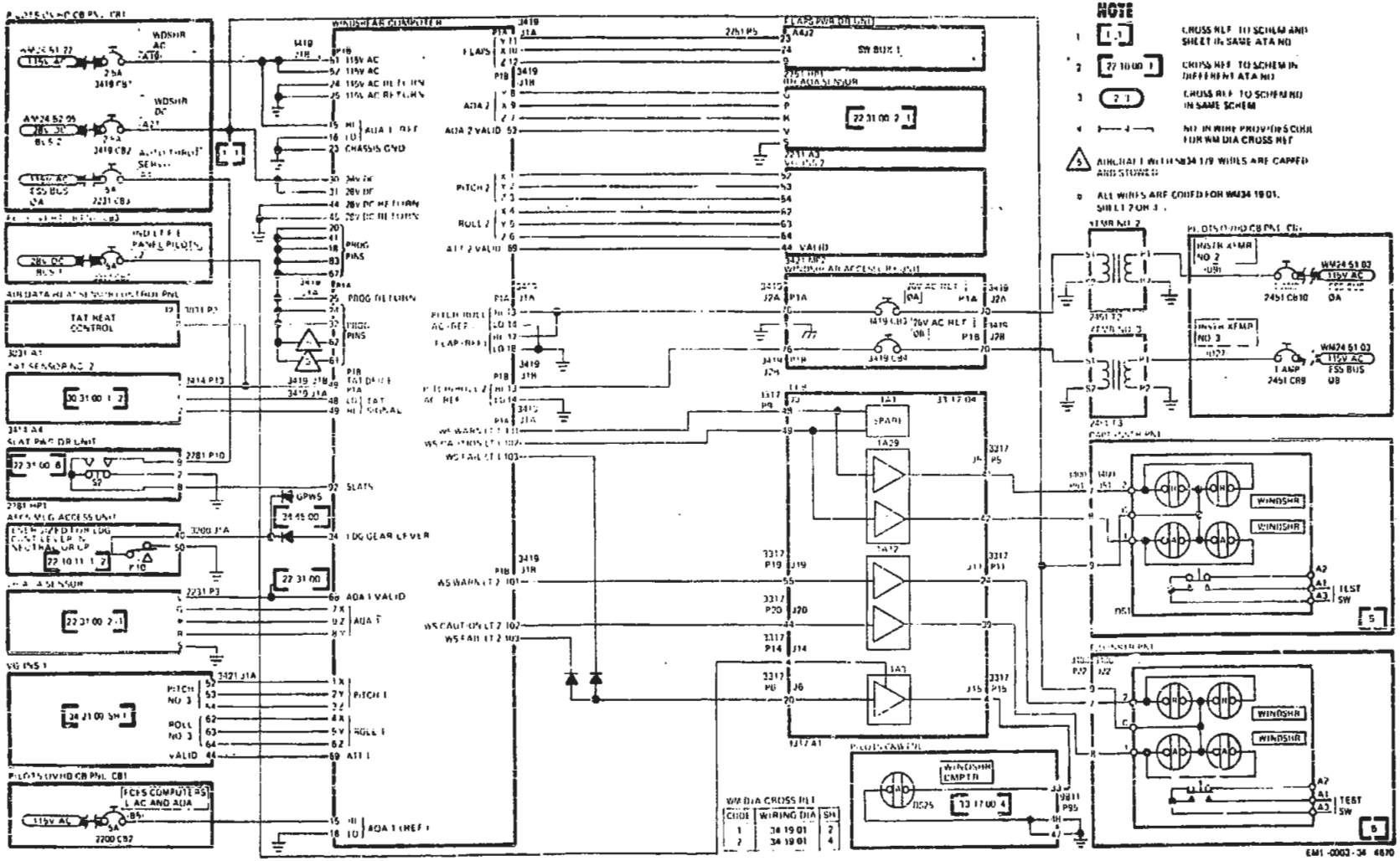
0019



R Windshear System - (F/O) Signal Flow Schematic
R SCHEM 2 (Sheet 4)

EFFECTIVITY: ALL

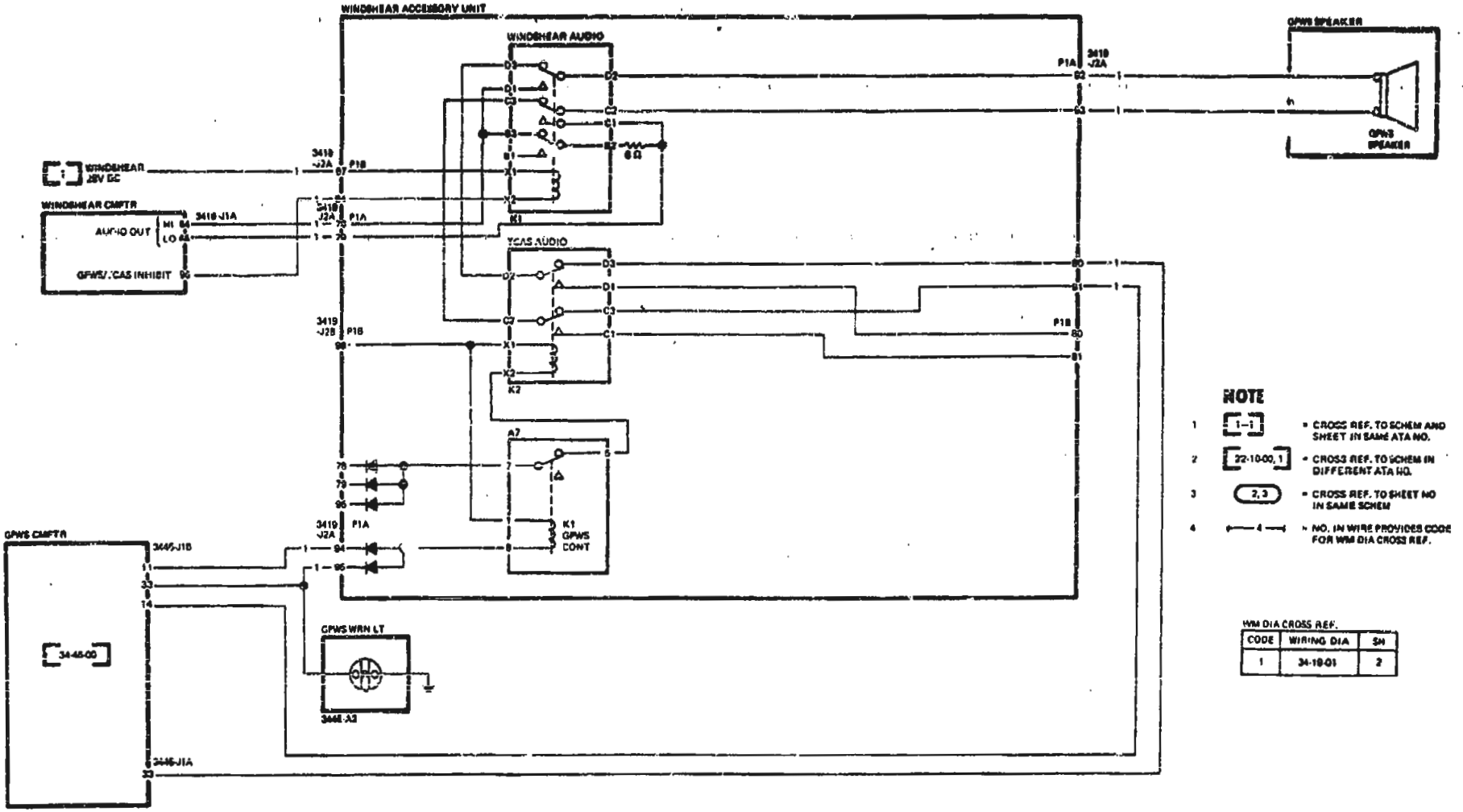
0018


NOTE
CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
CROSS REF TO SCHEM IN DIFFERENT ATA NO
CROSS REF TO SCHEM NO IN SAME SCHEM
NO IN WIRE PROVIDES CIRC FOR WM DIA CROSS REF
AIRCRAFT WITH W34 1/9 WIRES ARE CAPPED AND STOWED
ALL WIRES ARE CODED FOR WM34 1901, SHEET 2 OF 3
WINDSHR AC
WINDSHR DC
WINDSHEAR COMPUTER
FLAPS PWR DR UNIT
SW BUS 1
SPARE
WINDSHR EMPTR
WINDSHR
TEST SW
WM DIA CROSS REF
EM1-0003-34 4870

R Windshear System - Computer Interface Schematic
R SCHEM 3

EFFECTIVITY: ALL

001B



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2,3) = CROSS REF. TO SHEET NO IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

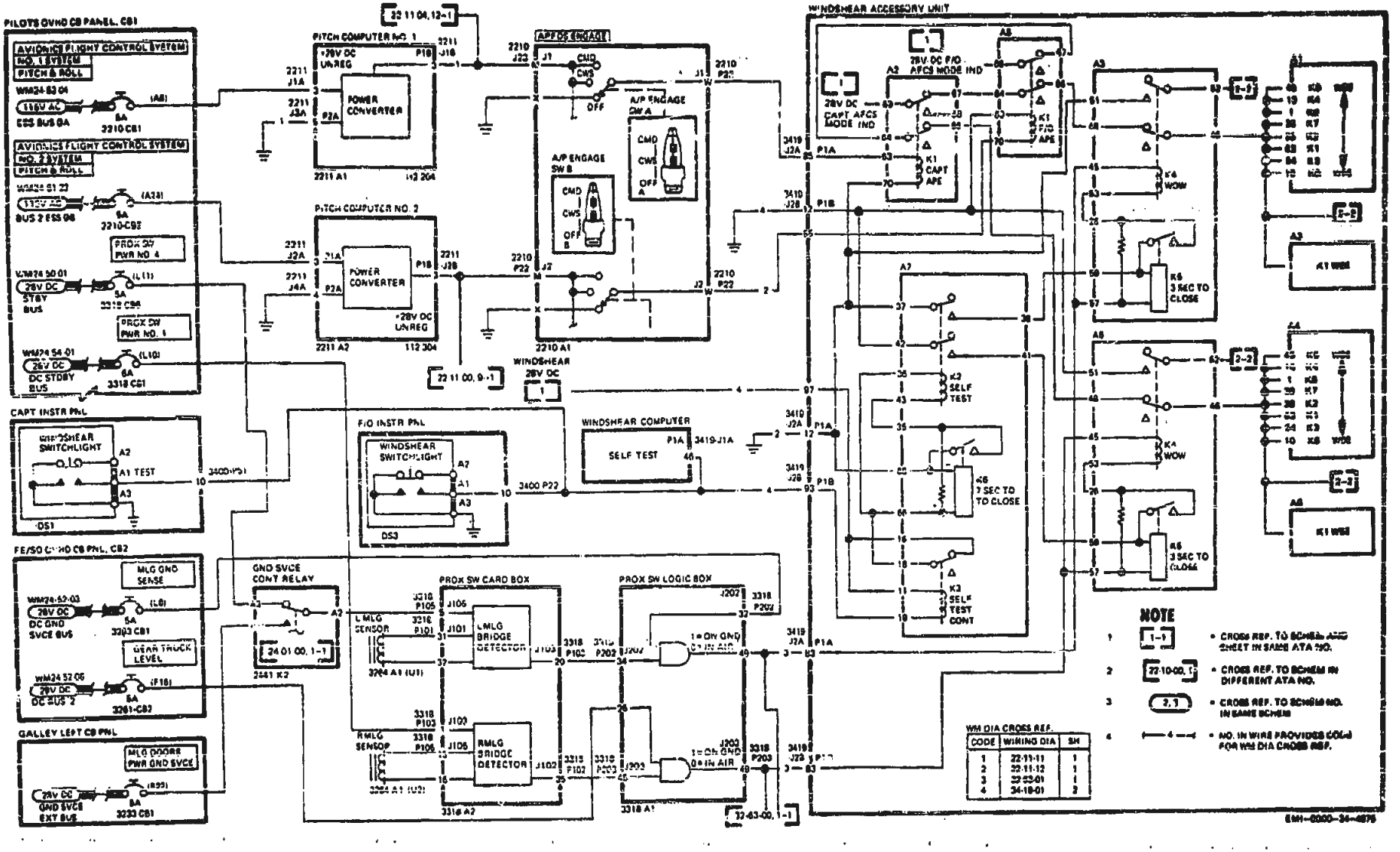
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	34-19-01	2

EM1-0000-34-4712

R 22 Windshear System - Aural Warning Schematic
SCHEM 4

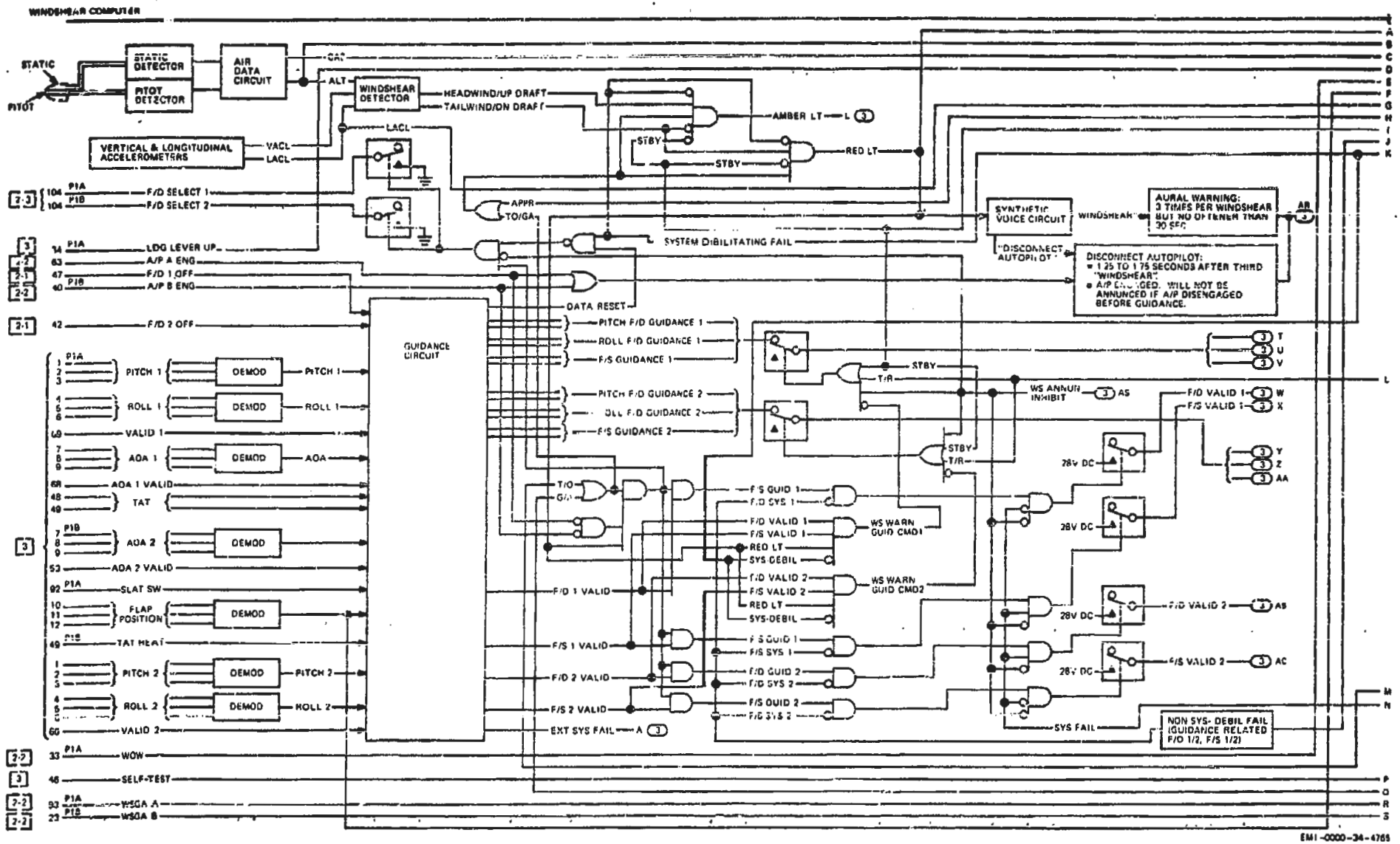
R EFFECTIVITY: ALL
R
001B



R Windshear System - Weight-on-Wheels and Self Test Schematic
R SCHEM 5

EFFECTIVITY: ALL

0018



R Windshear Computer Signal Flow Schematic
R SCHEM 6 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

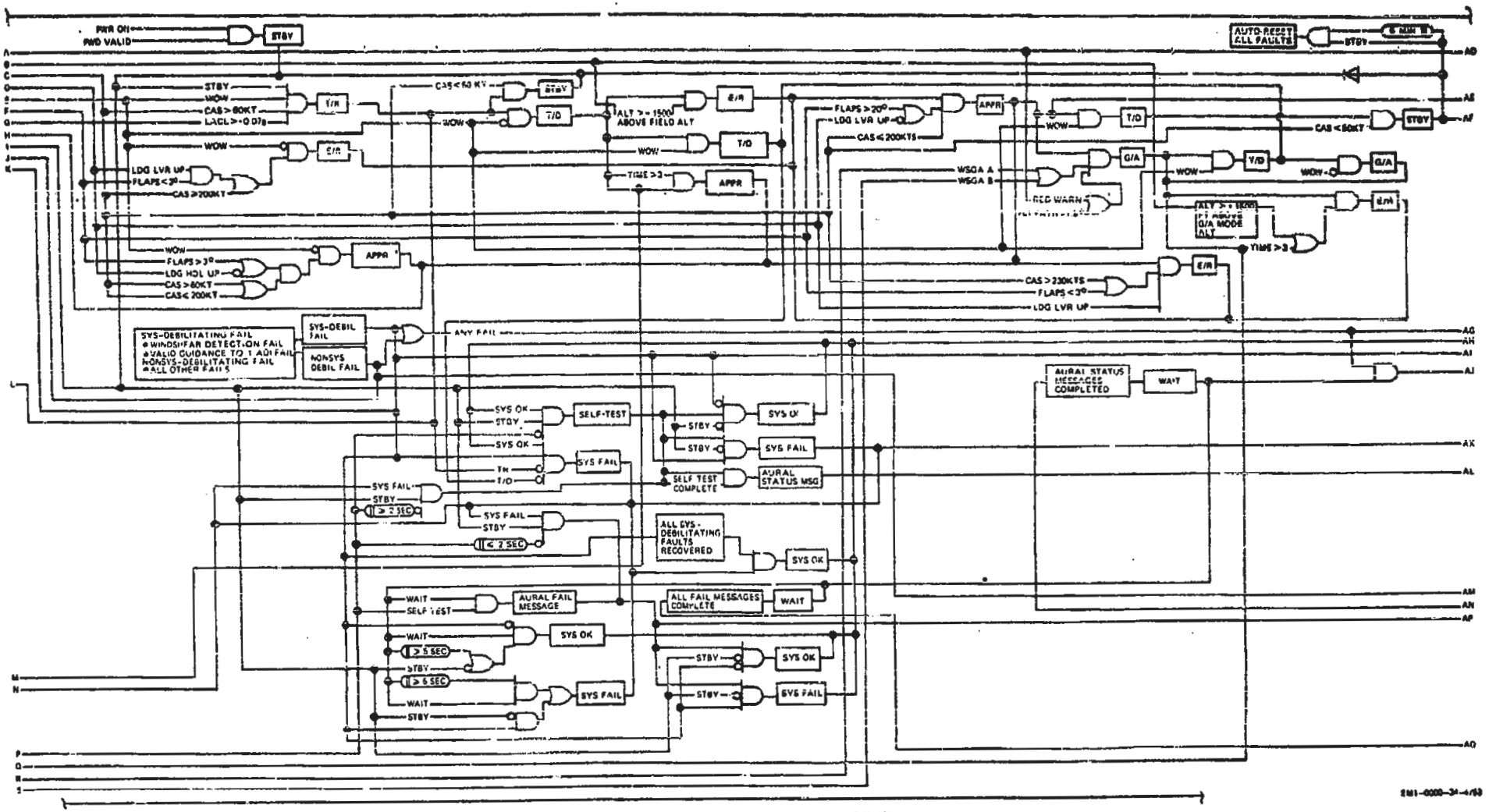
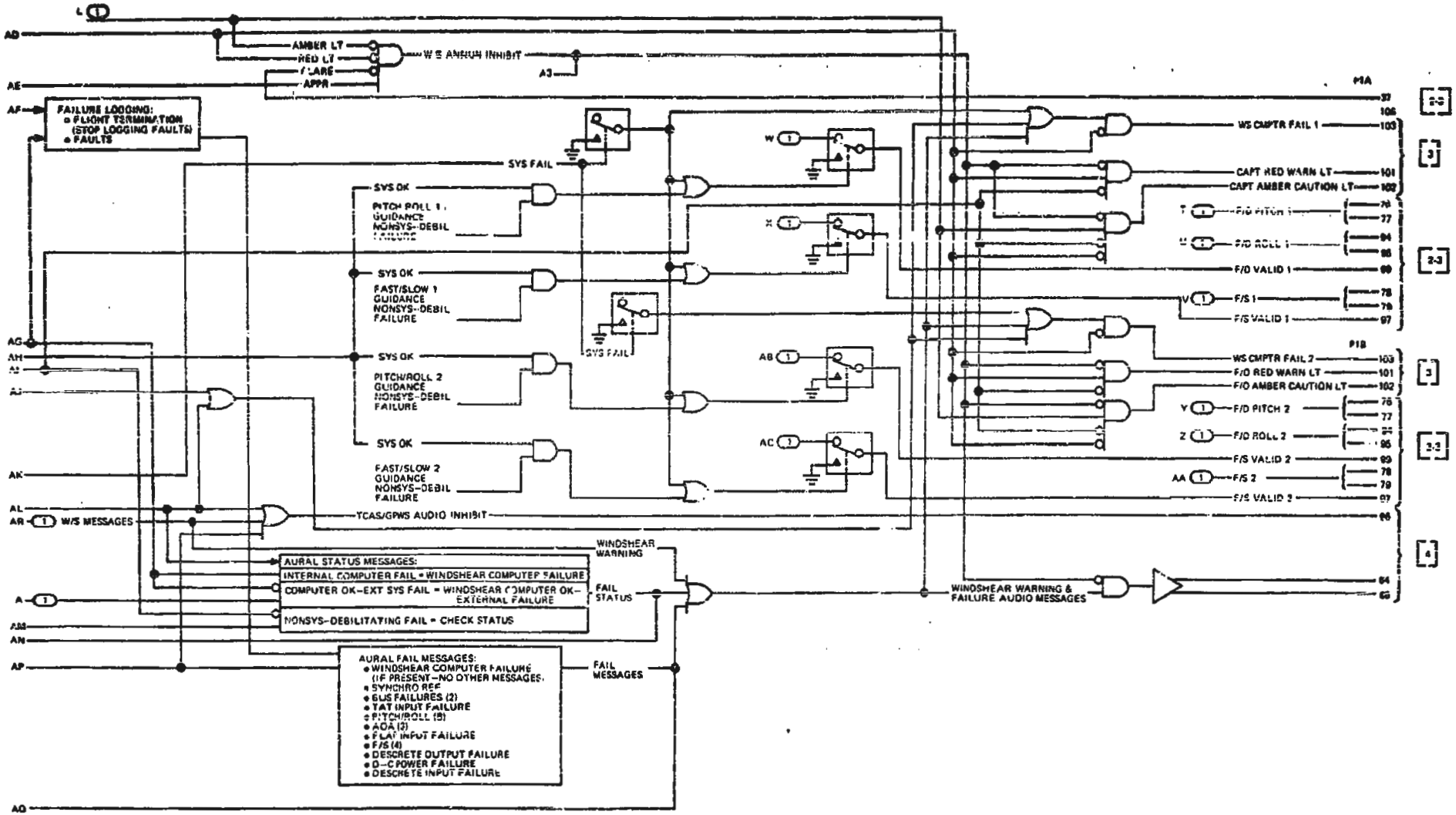


FIG 6-2 WINDSHEAR COMPUTER SIGNAL FLOW 001, 34 19-00, 101

R R Windshear Computer Signal Flow Schematic
SCHEM 6 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



EM1-0000-34-4766

R Windshear Computer Signal Flow Schematic
R SCHEM 6 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

WINDSHEAR SYSTEM MONITORING

CONTINUOUS BIT ACTIVE IN ALL MODES – (Set of test procedures run on an assigned execution rate)

DETECTION AND/OR ANNUNCIATION RELATED FAULTS

SYSTEM–DEBILITING FAILURE – Adversely Affects Operation Of W/S Detection & Annunciation

- Single failure of a single–source input
- Dual failure of a dual–source input
- Amber C&W *WINDSHR COMPTR* fail light illuminates
- Windshear Detection, Annunciation, and Guidance inhibited
- Both F/D Command Bars biased out of view and S–F Indicator flags in view (if guidance active)
- Both black–on–white APFDS *WINDSHR* annunciators remain in view (if guidance active)

NON SYSTEM–DEBILITING FAILURE – Does Not Adversely Affect Operation Of W/S Detection & Annunciation

- Single failure of a dual–source input
- Windshear Detection, Annunciation, and Guidance unaffected
- Amber C&W *WINDSHR COMPTR* fail light does not illuminate. Failure will be annunciated aurally upon completion of a System Self–Test (manually initiated on the ground, with acft. speed less than 30 knots)

GUIDANCE (F/D, S–F) RELATED FAULTS

All Are Non System–Debiliting Failures

- Only affected guidance function inhibited
- Only failed F/D Command Bar biased out of view, or S–F indicator flag in view (if guidance active)
- Both black–on–white APFDS *WINDSHR* annunciators remains in view (if guidance active)

CONTINUOUSLY ACTIVE FAILURE RECOVERY

Attempts to return W/S Computer to full–up status through one or more of 4 methods

- Auto–Recovery – Recovers once failure no longer exists for at least 5 sec.
- Power–Up – Recovers once power is cycled to W/S Cmptr. >1sec.
- Auto–Reset – Occurs 5 min. after the end of each flt. if on gnd.
- Accelerometer Self–Test – Recovers after successful completion of an accelerometer self–test (as part of a manually initiated System Self–Test or Power–Up on the gnd.)

FAILURE LOGGING

- First 16 distinct failures logged per flight by unique Fail Code nos. (each code logged only once per flt.)
- Failures of last 96 flights stored in non–volatile memory
- Data available at computer front panel test connector (ARINC 429 bus output)
  - All Fail Codes (via 14 ARINC Labels) and all current faults & analog & discrete input parameters available

WINDSHEAR DETECTION SYS. OPERATION

MI-6000-34-S014

INPUT/OUTPUT SIGNAL TESTS

ACCELEROMETER SELF-TEST – Fails when the accelerometer's internal self-test fails. Failure occurs if the test does not pass in 3 successive attempts, with 15 sec. between each attempt.

A/D CONVERSION – A/D Conversion Complete test - Fails if an A/D Conversion started in one RTC period is not completed by the next RTC. Multiplexer Calibration test - Fails if the A/D count for the +10V and gnd. signals are such that calibration values cannot be calculated.

ARINC RECEIVER – Fails if a parity test performed on ARINC 429 input words indicates bad parity.

ARINC TRANSMITTER – Fails upon loss of ARINC transmitter interrupt.

AURAL WARNING SYSTEM – A set of hardware and software tests of Aural Warning Sys. functions to detect faults in WSC internal circuitry. They include tests relating to Aural Warning Initialization, Message Active Monitoring, Interrupt Response, Message Timeout, Output Driver, and Output Monitoring.

COMPARISON – Fails if dual input signals differ from each other by more than a predetermined amount.

CONFIG. NOT SUPPORTED – Fails upon the determination of the existence of an *Aircraft*, *Option*, or *Environment* pin configuration that is not supported.

CONFIGURATION PARITY – Fails if any configuration discrete's parity is not correct (*Aircraft* and *Option* are normally odd, and *Environment* configuration is normally even).

DISCRETE VALIDITY – Fails when the status of discrete valid input from a sensor becomes invalid.

END-AROUND – Fails if a sampled output signal of the WSC does not agree with the signal's commanded value.

LEG – Fails upon loss of synchro excitation, or an open leg configuration exists.

LOSS OF FREQUENCY – Fails if the input frequency from either the Pitot or Static Sensor is too low for proper conversion.

MISC. INTERNAL TESTS – A set of Internal Circuitry tests, as well as tests to monitor Internal Processor Execution and the Processor Memory to determine if the hardware can reliably execute the software, or if data critical to the operation of the WSC is valid.

RANGE – Fails if an input signal's value is outside a predetermined range.

REASONABLENESS – Fails if an input signal's value does not satisfy a predetermined reasonableness criteria.

STEP – Fails when an input signal's value has taken a step in magnitude greater than a predetermined threshold, and has not returned to within a calculated boundary during a predetermined time.

SYNCHRO REFERENCE – Fails when hardware testing on an input reference signal indicates a failure.

TAT OPEN/SHORT – Fails when a short or open circuit is detected in the TAT probe element or aircraft wiring.

CONTINUOUS BIT – SIGNAL MONITORING

MI-0000-34-5015

INPUT SIGNAL Test Criteria

ACCELEROMETER Self-Test – Test is run 15 sec. after a non Auto-Reset power-up when the WSC is in the STBY mode and weight is on wheels.

A.O.A. Comparison Test – Test is not run in STBY, T/R, or T/D mode, or when Increasing or Decreasing Performance W/S is being annunciated, or when W/S Guidance is active.

A.O.A. Range Test – Test is not run when Increasing or Decreasing Performance W/S is being annunciated, or when W/S Guidance is active.

PITCH, ROLL, A.O.A., & FLAP Step Tests – Tests are not run in STBY mode.

PITCH, ROLL, ACCEL., & A.O.A. Range Tests – For Pitch, Roll & Accel., narrow limit range tests are run in STBY, T/R, or T/D modes The tolerances are widened in T/O, E/R, APPR, or G/A modes. The opposite criteria applies for A.O.A. Range Tests.

TAT A/D Conversion & TAT Range Tests – Tests are run only when CAS is greater than 100kts., or the heater has been off for at least 20 min.

REASONABLENESS TESTS:

Flap Reasonableness Test – A fault occurs if flaps are > 2 deg. and CAS is > 305 kts. Test is not run in STBY mode.

WOW 70 kt. Reasonableness Test – A fault occurs when weight is off wheels and CAS is < 70 kts. Test is not run for 12 sec. after the Self-Test Sw. is activated.

WOW 200 kt. Reasonableness Test – A fault occurs weight is on wheels and CAS is > 200 kts. Test is not run in STBY mode.

L/G 70 kt. Reasonableness Test – A fault occurs if the L/G is not down and CAS is < 70 kts.

L/G 305 kt. Reasonableness Test – A fault occurs if the L/G is down and CAS is > 305 kts. Test is not run in STBY mode.

LDG. EDGE Reasonableness Test #1 – A fault occurs if the L.E. slats are retracted and T.E. flaps are > 2 deg.

LDG. EDGE Reasonableness Test #2 – A fault occurs if the L.E. slats are extended and T.E. flaps are < 2 deg.

W/S ANNUNC. INHIBIT Reasonableness Test – A fault occurs if the W/S ANNUNC. INH. input discrete is set while in STBY or E/R mode.

OUTPUT SIGNAL Test Criteria

F/D PITCH/ROLL CMD., & F-S CMD. End-Around Tests – Tests are run only when the FD SELECT 1 or 2 input discrete is set.

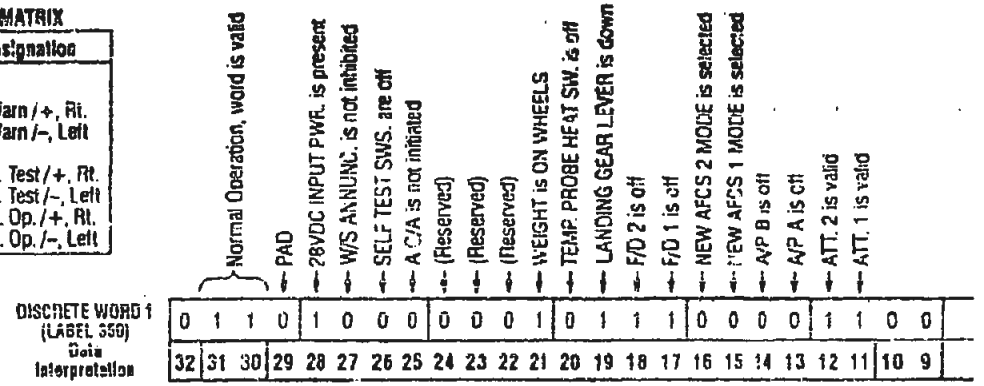
AURAL WARNING SYS. – Most of the tests are run when the AWS is active and the audio output is enabled during both audible as well as silent annunciations. The Output Monitor test is run only during audible annunciations.

SIGNAL TEST CRITERIA

M1-0000-34-5016

SIGN STATUS MATRIX

Bit No.			Designation
31	30	29	
0	0	0	Fail Warn /+, Rt.
0	0	1	Fail Warn /–, Left
0	1	0	NCD
1	0	0	Funct. Test /+, Rt.
1	0	1	Funct. Test /–, Left
1	1	0	Norm. Op. /+, Rt.
1	1	1	Norm. Op. /–, Left

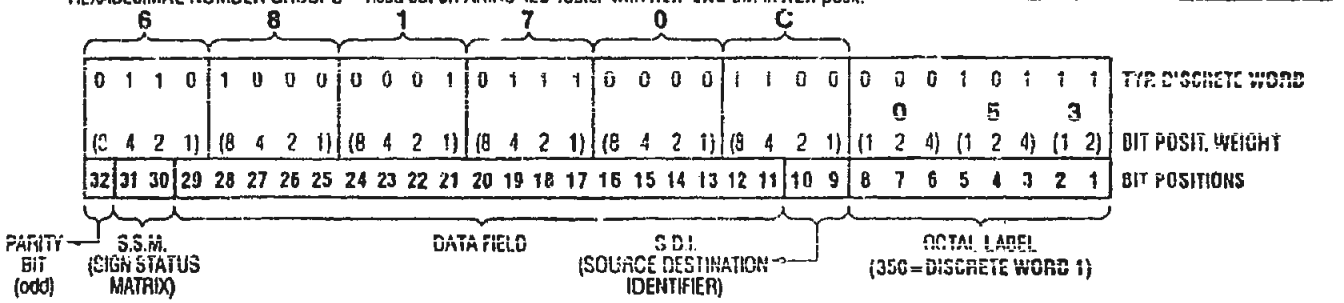

Normal Operation, word is valid
PAD
28VDC INPUT PWR. is present
W/S ANNUNC. is not inhibited
SELF TEST SWS. are off
A C/A is not initiated
(Reserved)
(Reserved)
(Reserved)
WEIGHT is ON WHEELS
TEMP. PROBE HEAT SW. is off
LANDING GEAR LEVER is down
F/D 2 is off
F/D 1 is off
NEW AFCS 2 MODE is selected
NEW AFCS 1 MODE is selected
A/P B is off
A/P A is off
ATT. 2 is valid
ATT. 1 is valid
DISCRETE WORD 1 (LABEL 350)
Data Interpretation
0 1 1 0 | 1 0 0 0 | 0 0 0 1 | 0 1 1 1 | 0 0 0 0 | 1 1 0 0
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9

NUMBER SYSTEMS (Comparison)

DECIMAL	BINARY	OCTAL	HEXA-DECIMAL
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

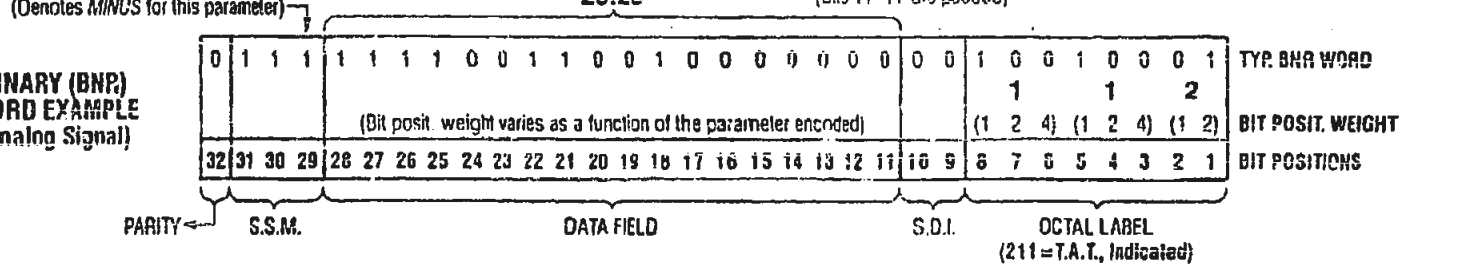
DISCRETE WORD EXAMPLE

HEXADECIMAL NUMBER GROUPS – Read out on ARINC 429 Tester with *HEX-ENG* sw. in *HEX* posit.


6 8 1 7 0 C
0 1 1 0 | 1 0 0 0 | 0 0 0 1 | 0 1 1 1 | 0 0 0 0 | 1 1 0 0 | 0 0 0 1 0 1 1 1
TYP. DISCRETE WORD
0 5 3
(8 4 2 1) (8 4 2 1) (8 4 2 1) (8 4 2 1) (8 4 2 1) (8 4 2 1) (1 2 4) (1 2 4) (1 2)
BIT POSIT. WEIGHT
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
BIT POSITIONS
PARITY BIT (odd)
S.S.M. (SIGN STATUS MATRIX)
DATA FIELD
S.D.I. (SOURCE DESTINATION IDENTIFIER)
OCTAL LABEL (350 = DISCRETE WORD 1)

BINARY (BNR) WORD EXAMPLE (Analog Signal)

BINARY VALUE – Read out on ARINC Tester with *HEX-ENG* sw. in *ENG* (Engineering Units) posit.


(Denotes MINUS for this parameter)
–25.25°
(Bits 11–17 are padded)
0 1 1 1 | 1 1 1 1 0 0 1 1 0 0 1 0 0 0 0 0 0 0 0 | 1 0 0 1 0 0 0 1
TYP. BNR WORD
1 1 2
(Bit posit. weight varies as a function of the parameter encoded)
(1 2 4) (1 2 4) (1 2)
BIT POSIT. WEIGHT
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
BIT POSITIONS
PARITY
S.S.M.
DATA FIELD
S.D.I.
OCTAL LABEL (211 = T.A.T., Indicated)

ARINC 429 BASICS FOR W/S MAINT. OUTPUT DATA

M1-0000-34-5017

LABEL	PARAMETER
137	FLAP POSIT. (Indicated, measured)
203	ALTITUDE (Indicated)
205	MACH (Indicated)
211	TAT (Indicated)
217	STATIC PRESS. (Indicated)
223	AOA 1 (Indicated, measured)
224	AOA 2 (Indicated, measured)
242	PITOT PRESS. (Indicated)
324	PITCH ATTITUDE 1,2
325	ROLL ATTITUDE 1,2
331	LONGITUDINAL ACCEL. (Indicated)
333	NORMAL ACCEL. (Indicated)
346	N1, engine #s 1-4 (Indic.) (n/a L 1011)

S.D.I. FOR LABELS LISTED ABOVE

	BIT 10	BIT 9
Indicated	0	0
Measured	1	0
PITCH/ROLL 1	0	1
PITCH/ROLL 2	1	0
N1, engine 1	0	1
N1, engine 2	1	0
N1, engine 3	1	1
N1, engine 4	0	0

272,273, 274,275	CURRENT FLT. FAIL CODES NOS. 1-4 (See 34-19-16)
27*	ALL CURRENT FLT. FAIL CODES
277,300, 301,302	PREV. FLTS. NOS.1-4 FAIL CODES (See 34-19-16)
303	ALL FAIL CODES IN MEMORY
350,351, 352,353	DISCRETE WORDS 1-4 (See Columns At Right)

(APPLICABLE TO ALL WORDS on this pg. ex. for the S.D.I. shown in the chart above.)

BIT POSIT.	BIT DEFINITIONS	STATE
32	Word Parity (odd)	
31,30	Sign Status Matrix	1,1
10,9	Source/Destination Identifier	0,0
8-1	Label (octal value)	

Label 350 - DISCRETE WORD 1

BIT POSIT.	BIT DEFINITIONS	STATE
29	Pad	0
28	28 VDC INPUT PWR.	
27	W/S ANNUNCIATION INHIBIT	
26	SELF TEST SW.	
25	WSGA	
24-22	Reserved	0
21	WEIGHT-ON-WHEELS	
20	TAT DEICE	
19	LDG. GEAR LEVER	1 = Down
18	FLT. DIR. 2 OFF	
17	FLT. DIR. 1 OFF	
16	NEW AFCS MODE 2	
15	NEW AFCS MODE 1	
14	AUTOPILOT B ENG'D.	
13	AUTOPILOT A ENG'D.	
12	ATTITUDE 2 VALID	
11	ATTITUDE 1 VALID	

Label 351 - DISCRETE WORD 2

BIT POSIT.	BIT DEFINITIONS	STATE
29,28	Pad	0
27	WSGA B	
26	WSGA A	
25	LEADING EDGE	Extended = 1
24	AOA 2 VALID	Valid = 1
23	AOA 1 VALID	Valid = 1
22	ACFT. CONFIG. 11 (PARITY-odd)	1
21	ACFT. CONFIG. 10	0
20	ACFT. CONFIG. 9	0
19	ACFT. CONFIG. 8	0
18	ACFT. CONFIG. 7	0
17	ACFT. CONFIG. 6	0
16	ACFT. CONFIG. 5	0
15	ACFT. CONFIG. 4	0
14	ACFT. CONFIG. 3	1
13	ACFT. CONFIG. 2	0
12	ACFT. CONFIG. 1	1
11	ACFT. CONFIG. 0	0

Label 352 - DISCRETE WORD 3

BIT POSIT.	BIT DEFINITIONS	STATE
29-27	Pad	0
26	ENVIRON. CONFIG. PARITY (even)	0
25-22	ENVIRON. CONFIG. 3,2,1,0	0
21	OPTION CONFIG. 10 (PARITY-odd)	1
20	OPTION CONFIG. 9 (WSC Orientation)	1
19	OPTION CONFIG. 8	0
18	OPTION CONFIG. 7	0
17	OPTION CONFIG. 6	0
16	OPTION CONFIG. 5	0
15	OPTION CONFIG. 4	1
14	OPTION CONFIG. 3	1
13	OPTION CONFIG. 2	0
12	OPTION CONFIG. 1	1
11	OPTION CONFIG. 0	0

Label 353 - DISCRETE WORD 4

BIT POSIT.	BIT DEFINITIONS	STATE
31	GPWS/TCAS INHIBIT	Inhibit On = 1
30,29	SYSTEM MONITORING	
	No Failure	0,0
	Ext. Failure	1,0
	Int. Failure	0,0
	Both Failures	1,1
28	GUIDANCE	Active = 1
27	GUIDANCE CONTROL LAW	
	Flt. Path Angle Control Law	0
	Airspeed Control Law	1
26,25	DETECTION STATUS	
	Inactive	0,0
	Caution	0,1
	Warning	1,0
	Temp. Lapse Rate	1,1
24	FLT. DIR. 1 OK (Capt.)	OK = 1
23	FLT. DIR. 1 OK (Capt.)	OK = 1
22	FLT. DIR. 2 OK (F/O)	OK = 1
21	FLT. DIR. 2 OK (F/O)	OK = 1
20	W/S ANNUNCIATED 1	ON = 1
19	FLT. DIR. 1 VALID (Capt.)	Valid = 1
18	FLT. DIR. 1 SELECT (Capt.)	Select = 1
17	FAST-SLOW 1 VALID (Capt.)	Valid = 1
16	W/S ANNUNCIATED 2	ON = 1
15	FLT. DIR. 2 VALID (F/O)	Valid = 1
14	FLT. DIR. 2 SELECT (F/O)	Select = 1
13	FAST-SLOW 2 VALID (F/O)	Valid = 1
12	WSC OK Discrete	OK = 1
11-9	WSC MODES	
	Standby	0,0,0
	Takeoff Roll	0,0,1
	Takeoff	0,1,0
	Enroute	0,1,1
	Approach	1,0,0
	Go Around	1,0,1
	Touchdown	1,1,0
	Spare	1,1,1

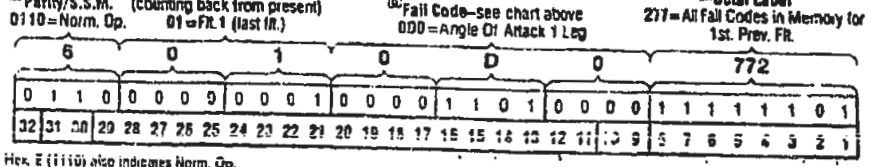
W/S ARINC 429 MAINT. OUTPUT PARAMETERS

M1-0000-34-5018

FAIL CODE	FAILURE DESCRIPTION	TYPE	FAIL LIGHT	RECOVERY
001	Processor, Memory, Intnl. Circuit Failures	Int.	*	(3)
-029				
030	Synchro Ref. 1 (Alt. 1)	Ext.	■	Auto
031	Synchro Ref. 2 (Alt. 2)	Ext.	■	Auto
032	Synchro Ref. 3 (A.O.A. 1)	Ext.	■	Auto
033	Synchro Ref. 4 (A.O.A. 2)	Ext.	■	Auto
034	Synchro Ref. 5 (Flaps)	Ext.	■	Auto
035	Synchro Ref. 6 (Flaps) (n/a L-1011)	Ext.	■	Auto
040	ARINC Xmtr. 1	Int.	*	Auto
041	ARINC Xmtr. 2	Int.	*	Auto
042	ARINC Rcvr. 1	Ext.	■	Auto
043	ARINC Rcvr. 2	Ext.	■	Auto
051	Norm Accelerometer Range	Int.	*	Auto
054	Long. Accelerometer Range	Int.	*	Auto
060	Accelerometer Self-Test (Longitudinal)	Int.	*	Self-Test
061	Accelerometer Self-Test (Normal)	Int.	*	Self-Test
070	TAT A/D Conversion	Ext.	*	Auto
072	TAT Range	Ext.	*	Auto
074	TAT Open	Ext.	*	Auto
075	TAT Short	Ext.	*	Auto
090	Prot. Static Pressure Sensor Failures	Int.	*	Auto
-09B				
0A1	Pitch Alt. 1 Leg	Ext.	■	Auto
0A2	Pitch Alt. 1 Range	Ext.	■	Auto
0A3	Pitch Alt. 1 Step	Ext.	■	Power-Up
0A5	Pitch Alt. 2 Leg	Ext.	■	Auto
0A6	Pitch Alt. 2 Range	Ext.	■	Auto
0A7	Pitch Alt. 2 Step	Ext.	■	Power-Up
0A8	Pitch Comparison	Ext.	■	Auto
0AC	Alt. Ref. 1 Valid	Ext.	■	Auto
0AD	Alt. Ref. 2 Valid	Ext.	■	Auto
0B1	Roll Alt. 1 Leg	Ext.	■	Auto
0B2	Roll Alt. 1 Range	Ext.	■	Auto
0B3	Roll Alt. 1 Step	Ext.	■	Power-Up
0B5	Roll Alt. 2 Leg	Ext.	■	Auto
0B6	Roll Alt. 2 Range	Ext.	■	Auto
0B7	Roll Alt. 2 Step	Ext.	■	Power-Up
0B8	Roll Comparison	Ext.	■	Auto
0D0	AOA 1 Leg	Ext.	■	Auto
0D1	AOA 1 Range	Ext.	■	Auto
0D2	AOA 1 Step	Ext.	■	Power-Up
0D3	AOA 1 Valid	Ext.	■	Auto
0D4	AOA 2 Leg	Ext.	■	Auto
0D5	AOA 2 Range	Ext.	■	Auto
0D6	AOA 2 Step	Ext.	■	Power-Up
0D7	AOA 2 Valid	Ext.	■	Auto
0D8	AOA Comparison	Ext.	■	Auto
0D9	AOA 1 Excitation (n/a L-1011)	Ext.	■	Auto
0DA	AOA 1 Validity (n/a L-1011)	Ext.	■	Auto
0DB	AOA 2 Excitation (n/a L-1011)	Ext.	■	Auto
0DC	AOA 2 Validity (n/a L-1011)	Ext.	■	Auto
0E0	Flap Leg	Ext.	*	Auto
0E1	Flap Reasonableness	Ext.	*	Auto
0E2	Flap Range	Ext.	*	Auto
0E3	Flap Step	Ext.	*	Power-Up
0E4	Leading Edge Reasonableness 1	Ext.	*	Auto
0E5	Leading Edge Reasonableness 2	Ext.	*	Auto
0F0	Nr 1 Range (n/a L-1011)	Ext.		Auto
0F1	Nr 2 Range (n/a L-1011)	Ext.		Auto
0F2	Nr 3 Range (n/a L-1011)	Ext.		Auto
0F3	Nr 4 Range (n/a L-1011)	Ext.		Auto
0F4	Nr 1 Reasonableness (n/a L-1011)	Ext.		Auto
0F5	Nr 2 Reasonableness (n/a L-1011)	Ext.		Auto
0F6	Nr 3 Reasonableness (n/a L-1011)	Ext.		Auto
0F7	Nr 4 Reasonableness (n/a L-1011)	Ext.		Auto
110	FAST-SLOW 1 Valid End-Around	Ext.		Auto
111	F/D 1 Valid End-Around	Ext.		Auto
112	F/D 1 Select End-Around	Ext.		Auto
113	GPWS/TCAS Inhibit End-Around	Ext.		Auto
114	F/D 1 Mode Validity (n/a L-1011)	Ext.		Auto
118	FAST-SLOW 1 Analog Cmd. End-Around	Ext.		Auto
119	F/D 1 Pitch Analog Cmd. End-Around	Ext.		Auto
11A	F/D 1 Roll Analog Cmd. End-Around	Ext.		Auto
120	FAST-SLOW 2 Valid End-Around	Ext.		Auto
121	F/D 2 Valid End-Around	Ext.		Auto
122	F/D 2 Select End-Around	Ext.		Auto
124	F/D 2 Mode Validity (n/a L-1011)	Ext.		Auto
128	FAST-SLOW 2 Analog Cmd. End-Around	Ext.		Auto
129	F/D 2 Pitch Analog Cmd. End-Around	Ext.		Auto
12A	F/D 2 Roll Analog Cmd. End-Around	Ext.		Auto
130	Aural Warn. Output Monitor	Int.		Auto
131	Aural Warn. Output Driver	Int.	*	Auto
132	Aural Warn. Message Active Monitor	Int.	*	Auto
134	Aural Warn. Message Timeout	Int.	*	Auto
135	Aural Warn. Initialization	Int.	*	Power-Up
136	Aural Warn. Interrupt Response	Int.	*	Auto
138	28 VDC Bus Monitor 1 (n/a L-1011)	Ext.	*	Auto
139	28 VDC Bus Monitor 2 (n/a L-1011)	Ext.	*	Auto
13A	28 VDC Power Input	Ext.	*	Auto
140	Weight-On-Wheels 70kt. Reasonableness	Ext.	*	Auto
141	Landing Gear 70kt. Reasonableness	Ext.	*	Auto
142	Actl. Configuration Not Supported	Ext.	*	Power-Up
143	Actl. Configuration Parity	Ext.	*	Power-Up
144	One Environment Configuration Selected	Ext.	*	Power-Up
145	Environment Configuration Parity	Ext.	*	Power-Up
146	Option Configuration Parity	Ext.	*	Power-Up
147	Option Configuration Not Supported	Ext.	*	Power-Up
148	G/A Discrete (Momentary) (n/a L-1011)	Ext.		Auto
14B	Weight-On-Wheels 200kt. Reasonableness	Ext.	*	Auto
14C	Landing Gear 305kt. Reasonableness	Ext.	*	Auto
14D	WSS Annunc. Inhibit Reasonableness	Ext.		Auto

(1) The failure is System-Debilitating and will illuminate the Fail Light if a single failure occurs on both input sources (No. 1&2). The failure is Non System-Debilitating and will not illuminate the Fail Light if all inputs to the opposite source are valid.
(2) The failure will occur only while the ARINC bus is in use.
(3) Most W/S Cmptr. Processor, Memory, & Internal Circuit failures recover on Power-Up, a few are Auto-Recovery.

NOTE: "Auto" Recovery signifies that a failure clears once the malfunction is no longer present for at least 5 sec. All failures that reset on "Power-Up" will also reset during an "Auto-Reset" which occurs 5 min. after transition into Stby. mode from Apln each mode.

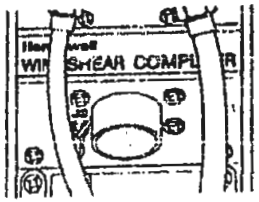

(4) Parity/S.S.M.
0110 = Norm. Op.
(5) Flight No. (counting back from present)
01 = Flt. 1 (last flt.)
(6) Fail Code—see chart above
0D0 = Angle Of Attack 1 Leg
(7) Octal Label
277 = All Fail Codes in Memory for 1st. Prev. Flt.
6
0
1
0
D
0
772
0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 1 0 0 0 0 1 1 1 1 1 1 0 1
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

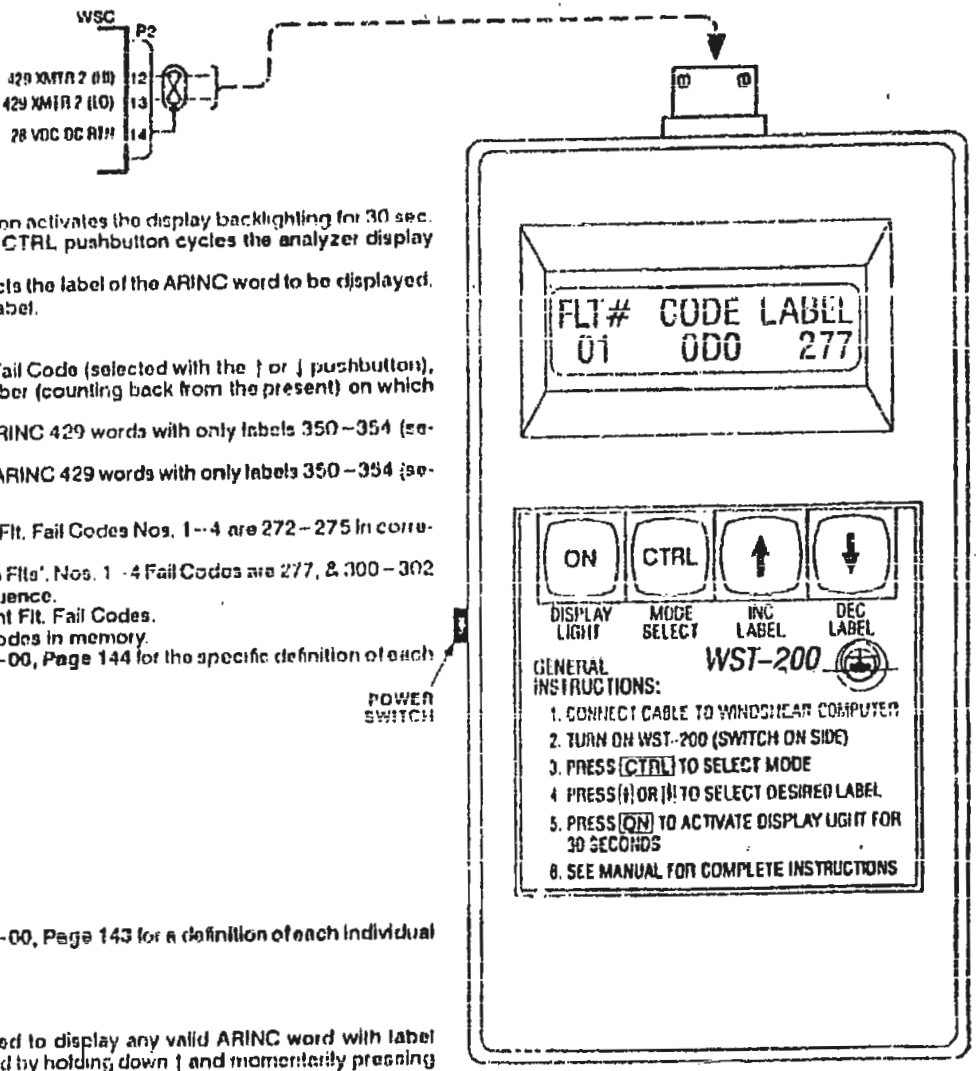
(4) Hex. E (1110) also indicates Norm. Op.
(5) 00 indicates Current Flt. A Flt. terminates when transitioning from Touchdown into Stby. mode. The next flt. begins immediately.
(6) A Hex 8 is added if a failure occurs in Stby. mode - On the ground (for example: 0D0 becomes 8D0, 148 becomes 948)
(7) Discrete Word Labels 272-275 = Current Flt. Fail Codes Nos. 1-4 Labels 277, 300-303 = Prev. Flts. Nos. 1-4 Fail Codes (A cyclic display, at a 2 sec rate, of all codes for the specified flt.) Label 276 = All Current Flt. Fail Codes Label 303 = All Fail Codes stored in Memory

W/S ARINC 429 MAINT. OUTP. PARAMETERS–FAIL CODES

MI-0000-34-5019

R EFFECTIVITY: ALL
R
0018





CONTROLS:

Display Light pushbutton – Each press of the ON pushbutton activates the display backlighting for 30 sec.

Mode Select pushbutton – Each successive press of the CTRL pushbutton cycles the analyzer display through the 3 main operational modes (see below).

Increment Label, & Decrement Label pushbuttons – Selects the label of the ARINC word to be displayed. Pressing ↑ increments the label. Pressing ↓ decrements the label.

OPERATIONAL MODES:

Fail Code Mode – Displays the Current or Previous Flts'. Fail Code (selected with the ↑ or ↓ pushbutton), along with the applicable ARINC 429 label, and the flight number (counting back from the present) on which the failure occurred.

Discrete Data Hex Mode – Displays the data portion of ARINC 429 words with only labels 350–354 (selected with the ↑ or ↓ pushbutton) in hexidecimal format.

Discrete Data Binary Mode – Displays the data portion of ARINC 429 words with only labels 350–354 (selected with the ↑ or ↓ pushbutton) in binary format.

FAIL CODE MODE

```
FLT#  CODE  LABEL
01    0D0   277
```

The labels for Current Flt. Fail Codes Nos. 1–4 are 272–275 in corresponding sequence.
The labels for Previous Flts'. Nos. 1–4 Fail Codes are 277, & 300–302 in corresponding sequence.
Label 276 is All Current Flt. Fail Codes.
Label 303 is All Fail Codes in memory.
Refer to M.M. 34–19–00, Page 144 for the specific definition of each Code No.

DISCRETE DATA HEX MODE

```
DISC LABEL# 350
HEX DATA 68170C
```

DISCRETE DATA BINARY MODE

LABEL BIT 32 BIT 25

```
DIS 350 01101000
00010111000011100
```

BIT 24 BIT 9

Refer to M.M. 34–19–00, Page 143 for a definition of each individual bit.

OTHER OPERATIONAL MODES: The analyzer may be used to display any valid ARINC word with label 000–377 in Hex or Binary Format Mode. Hex Mode is selected by holding down ↑ and momentarily pressing CTRL. Binary Mode is selected by holding down ↓ and momentarily pressing CTRL.

WINDSHEAR COMPUTER FAIL CODE ANALYZER

M1-0000-34-5020

R WINDSHEAR SYSTEM - MAINTENANCE PRACTICES

R 1. General

R The following procedure specifies the method used to de-activate
R the windshear system if the aircraft is to be dispatched with
R the windshear system inoperative (Ref. MEL 34-62-00).

R NOTE: This de-activation procedure applies only when an
R aircraft is to be dispatched in accordance with the MEL.

R 2. De-activation

R A. On pilots overhead circuit breaker panel CB1, open and tag
R the following circuit breakers:

R AVIONICS FLIGHT CONTROL SYSTEM - WDSHR AC (A19)

R AVIONICS FLIGHT CONTROL SYSTEM - WDSHR DC (A27)

R B. Install a placard on the instrument panel in a prominent
R place, WINDSHEAR SYSTEM INOPERATIVE.

R C. Make appropriate entry in the aircraft log book.

WINDSHEAR WARNING AND GUIDANCE SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

24-00-00 Electrical Power - Maintenance Practices

R 29-11-00 Hydraulic Power System - Maintenance Practices

2. Adjustment/Test

R A. Windshear System Self-Test

NOTE: Satisfactory performance of the WSS (Windshear C System) Self-Test ascertains that WSS is operational.

To facilitate system testing, see Figure 501 for component location.

(1) On pilots overhead circuit breaker panel, CB1, verify the following circuit breakers are closed:

WINDSHEAR AC (A19)

WINDSHEAR DC (A27)

(2) In forward electronic service center, on forward left rack, verify both 26 VAC REF circuit breakers on windshear accessory unit are closed.

(3) Turn on electrical power (Ref. 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (4) Turn on hydraulic systems A and C (Ref. 29-11-00).

R (5) Verify the following systems are operational:

System	ATA Reference
Autopilot/Flight Director	22-00-00
Speed Control System	22-31-00
Flaps	27-51-00
Slats	27-81-00
Pitot Heater	30-31-00
Air/Ground Sensing	32-63-00
Caution and Warning Lights	33-17-00
Pitot/Static	34-13-00
Attitude Reference	34-21-00

R (6) Set both autopilot and flight director switches to off
R and verify all three throttles are at idle.

R (7) On Capt (F/O) instrument panel press and release windshear switchlight (self-test).

RESULTS: Verify results are as shown in Figure 502 except guidance does not appear.

R (8) Set Capt (F/O) F/D switch to ON.

R (9) Press self-test switch then press Capt (F/O) control wheel TO/GA switch.

R RESULTS: Verify results are same as Figure 502.
R Verify Capt (F/O) ADI guidance appears <u>after</u> TO/GA switch is pressed.

<u>NOTE</u>: For best test results press either pilot's control wheel TO/GA switch immediately after pressing self-test switch. TO/GA appears on both AFCS MODES indicators.

R (10) Press self-test switch.

RESULTS: Windshear guidance is engaged immediately.
R Verify flight director bars and fast/slow pointers are
R active on both ADIs. Repeat test as necessary to
R verify pitch - up and down, roll - right and left, and
R fast and slow indicator movements on both ADIs.

R (11) Set both F/D switches to OFF.

R (12) Press self-test switch and immediately advance throttle
R levers 1 and 2.

R RESULTS: Verify windshear guidance appears when
R throttle levers are greater than normal approach thrust
R (approximate location of DLC stow switch between
R throttle positions 6 and 8).

R (13) Retard throttles to idle.

R (14) Repeat Steps (12) and (13) using throttle levers 1 and
R 3.

R (15) Repeat Steps (12) and (13) using throttle levers 2 and
R 3.

R (16) Turn off Hydraulic power if no longer required (Ref.
R 29-11-00).

R (17) Turn off Electrical power if no longer required (Ref.
R 24-00-00).

C B. Functional Check of Throttle Switch Activation of Windshear
C Guidance

C (1) Verify that both F/D switches are off and that
C throttles are at idle.

C (2) On Capt (F/O) instrument panel press and release
C windshear switchlight (self-test).

C (3) Verify that WINDSHR caution lamps, warning lamps,
C failure lamp and aural warning operate during the eight
C seconds test period. Verify that windshear guidance
C mode does NOT engage. Repeat test as necessary to
C verify results.

C NOTE: Windshear guidance mode engaged is annunciated
C by the display of a WINDSHR message on each
C pilots AFCS MODES indicator.

C (4) Turn on either F/D.

C (5) Activate WSS self-test switch and then press TO/GA
C switch.

C (6) Verify that windshear guidance mode is not engaged
C until TO/GA switch is pressed.

C (7) With at least one F/D switch on, engage TO/GA mode.
C Verify that TO/GA is displayed on both AFCS MODE
C indicators.

C (8) Activate WSS self/test switch.

C (9) Verify that windshear guidance mode is engaged
C immediately and that flight director bars and fast/slow
C pointers are active on both pilots ADIs. Repeat test
C as necessary to verify pitch - up and down, roll -

C right and left, and fast and slow indicator movements
C on both ADIs.

C (10) Turn off both F/D.

C (11) Activate WSS self-test switch and then advance any
C throttle levers 1 and 2 forward.

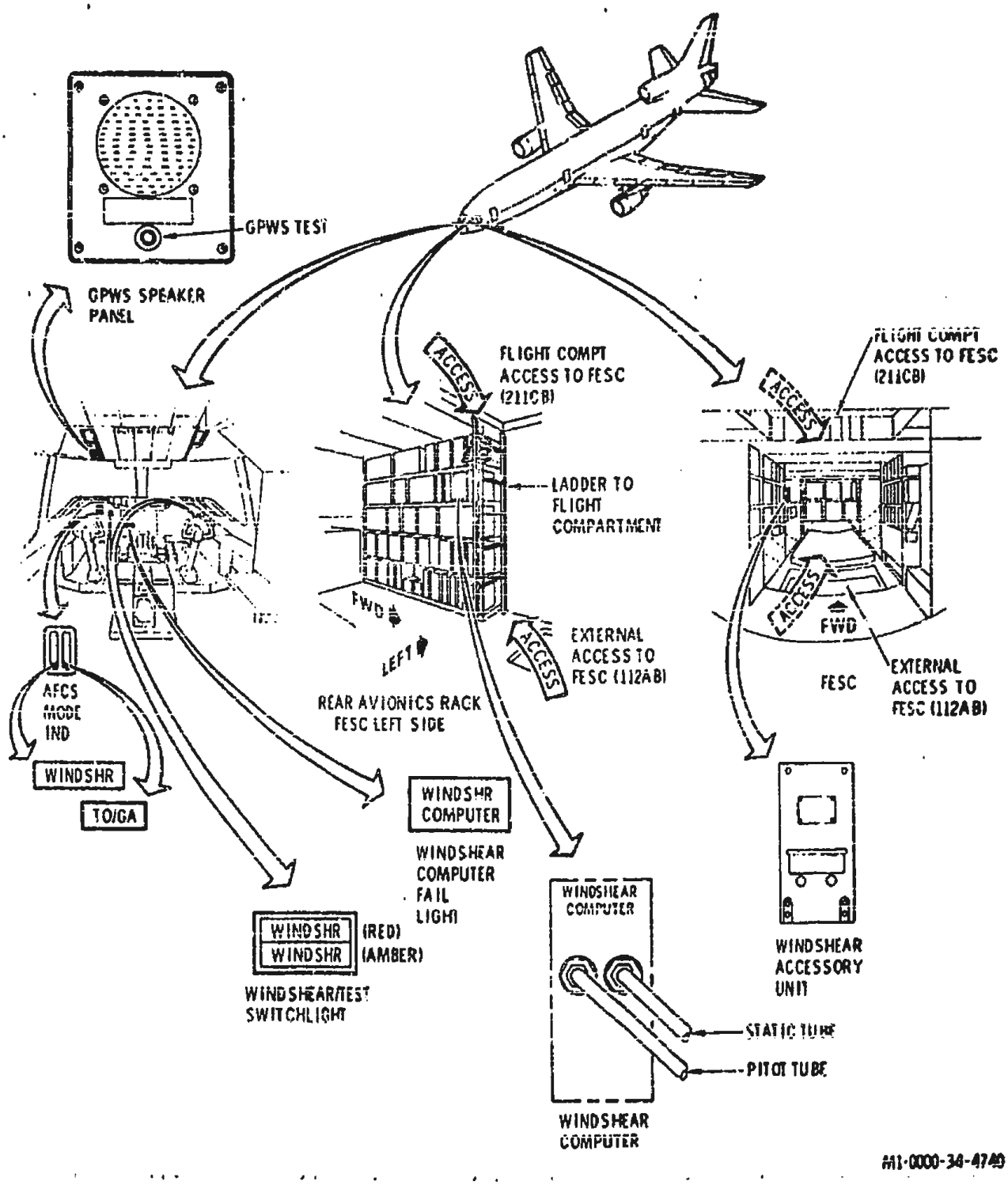
C (12) Verify that windshear guidance mode engaged when
C throttle levers reach the approximate location of DLC
C stow switch.

C (13) Repeat Step (12) using throttle levers 2 and 3.

C (14) Repeat Step (12) using throttle levers 1 and 3.

C (15) Turn off hydraulic power, reference Maintenance Manual
C 29-11-00.

C (16) Turn off electrical power, reference Maintenance Manual
C 24-00-00.



Windshear Component Locations
Figure 501

R EFFECTIVITY: AIRCRAFT WITH SB34-178 AND
R SB34-179
001B

INDICATIONS	TIME IN SECONDS			
	0–1	1–4	4–7	7–8
BOTH AMBER WINDSHEAR CAUTION LTS FLASH	FLASHING (2)		OFF	
BOTH RED WINDSHEAR CAUTION LTS FLASH	OFF		FLASHING (2) (3)	
WINDSHEAR COMPUTER C&W LT	ON			
AURAL ANNUNCIATION	SILENT		WINDSHEAR ANNUNCIATED AT A LOW VOLUME	
BOTH F/D PITCH COMMAND (1) (4)	CENTERED	UP HALF SCALE	DOWN HALF SCALE	CENTERED
BOTH F/D ROLL COMMAND (1) (4)	CENTERED	RT HALF SCALE	LT HALF SCALE	CENTERED
BOTH F/S COMMAND (1) (4)	CENTERED	FAST FULL SCALE	SLOW FULL SCALE	CENTERED
BOTH F/D FLAG	OUT OF VIEW			IN VIEW
BOTH F/S FLAG	OUT OF VIEW			IN VIEW

(1) EITHER TO/GA SWITCH MUST BE PRESSED TO GET THESE RESULTS.

(2) FLASHING STOPS 1 SECOND AFTER PRESSING TO/GA SWITCH.

(3) FLASHING STOPS 1 SECOND AFTER COMPLETION OF SELF-TEST.

(4) THE PITCH COMMAND, ROLL COMMAND, AND F/S COMMAND SHALL SNAP TO THE CENTER POSITION AND THEN SMOOTHLY SWEEP AT A CONSTANT RATE THROUGH THE SCALE POSITIONS.

MI–0001–34–4781

Windshear Self-Test Results
Figure 502

WINDSHEAR COMPUTER - REMOVAL AND INSTALLATION

1. General

The windshear system computer (WSC) is located in the forward electronic service center on the fourth shelf of the rear avionics rack.

2. Referenced Procedures

34-13-00	Pitot-Static System - Adjustment and Test
34-14-00	Analog/Digital Air Data Computer - Adjustment and Test
34-19-00	Windshear System - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

R AUTO THROT SERVO (A1)

R WDSHR AC (A19)

R WDSHR DC (A27)

R AFCS MODES IND (B3)

R FCES COMPTR AC & AOA (B5)

R SPEED CONT (A2) and (A20)

R PITCH & ROLL (A6) and (A24)

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate windshear computer on rear avionics rack, shelf 4 (Ref. Fig. 401).

(3) Remove pitot and static lines by pulling back on forward part of quick disconnect and pulling disconnect from computer.

(4) Rotate fluted knobs (hold-down extractors) to their fullest extent anti-clockwise to ensure WSC is

extracted. Disengage fluted knob securing WSC to rack mount.

Pull WSC forward until rear connectors are disengaged from mating connectors. Remove WSC.

NOTE: Excessive force is not required if WSC multi-contact connectors are fully disengaged in preceding step.

(5) Seal pitot and static ports to prevent ingress of moisture or dirt during transit.

B. Installation

(1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

(2) Position WSC on shelf, slide into place aligning rear connectors and mating connectors.

(3) Place holddown extractors over WSC hooks.

(4) Tighten fluted knobs securing WSC to shelf (mount). Unit is correctly tightened when:

(a) Fluted knobs slip on their clutch and

(b) Red band positioned between front of fluted knob and dome of hold-down unit is no longer in view.

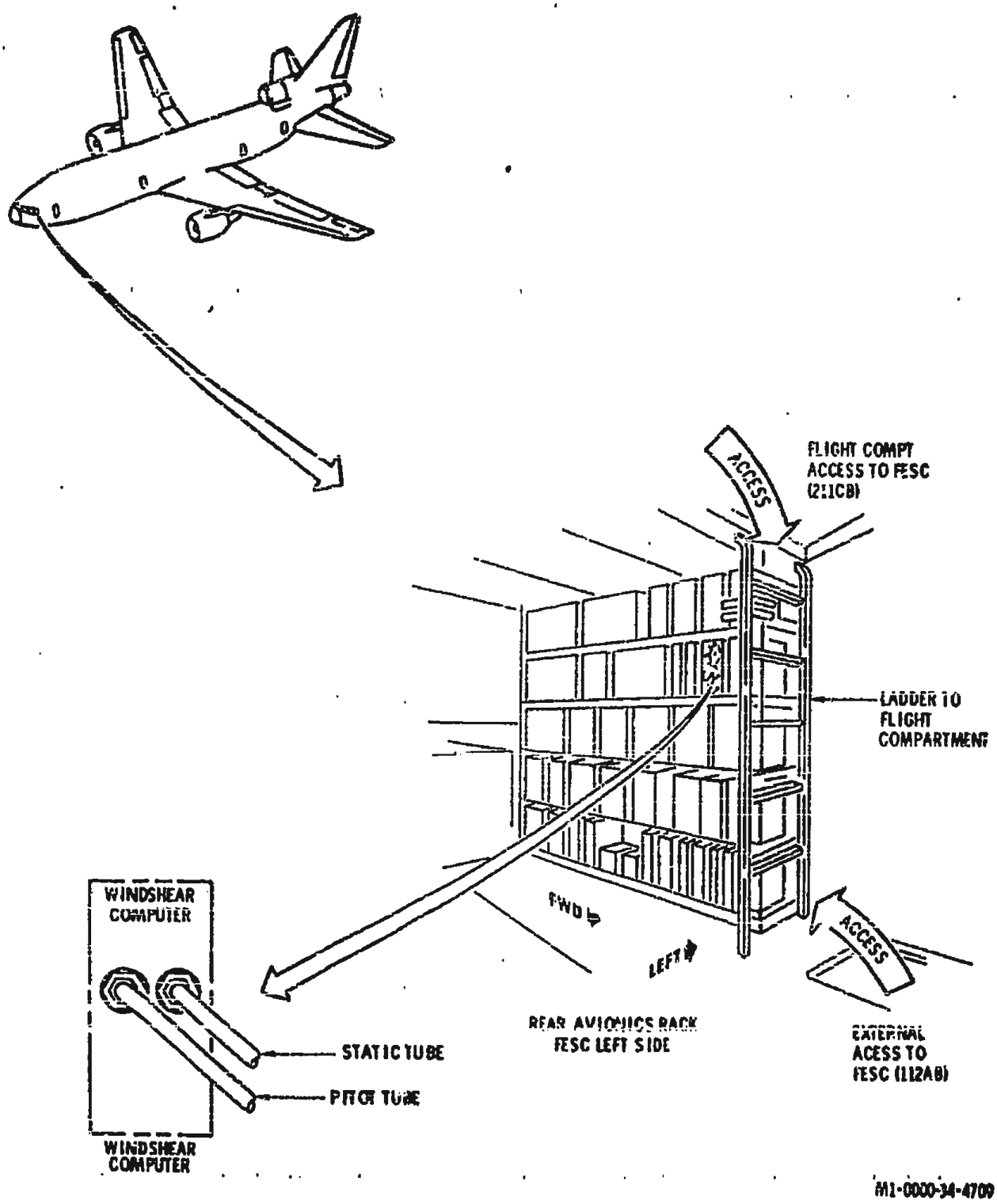
(5) Connect pitot and static lines to PITOT and STATIC connectors on front of WSC (Ref. Fig. 401).

(6) Close and secure access door.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

CR (8) Perform leak check on F/O's primary pitot-static system (Ref. 34-13-00).

(9) Perform WSC SELF-TEST procedure (Ref. 34-19-00).



R R Windshear Computer - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: ALL

R **WINDSHEAR ACCESSORY UNIT - REMOVAL AND INSTALLATION**

R 1. General

R The windshear system accessory unit (WSAU) is located in the
R forward electronic service center on the upper shelf of the
R directional gyro/INS battery rack.

R 2. Referenced Procedures

R 34-19-00 Windshear System - Adjustment and Test

R 3. Removal/Installation

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag following circuit breakers:

R AUTO THRUST SERVO (A1)

R WDSHR DC (A19)

R WDSHR AC (A27)

R AFCS MODES IND (B3)

R FCES COMPTR AC & AOA (B5)

R SPEED CONT (A2) and (A20)

R PITCH & ROLL (A6) and (A24)

R (2) Open access door 112AB and enter forward electronic
R service center, zone 112. Locate windshear accessory
R unit on upper shelf of directional gyro rack (Ref. Fig.
R 401).

R (3) Rotate fluted knobs (hold-down extractors) to their
R fullest extent anti-clockwise to ensure WSAU is
R extracted. Disengage fluted knob securing WSAU to rack
R mount.

R Pull WSAU forward until rear connectors are disengaged
R from mating connectors. Remove WSAU.

R NOTE: Excessive force is not required if WSAU
R multi-contact connectors are fully disengaged in
R preceding step.

R B. Installation

R (1) Verify circuit breakers opened in Step 3A(1) are open
R and tagged.

R (2) Position WSAU on shelf, slide into place aligning rear
R connectors and mating connectors.

R (3) Place hold-down extractors over WSAU hooks.

R (4) Tighten fluted knobs securing WSAU to shelf (mount).
R Unit is correctly tightened when:

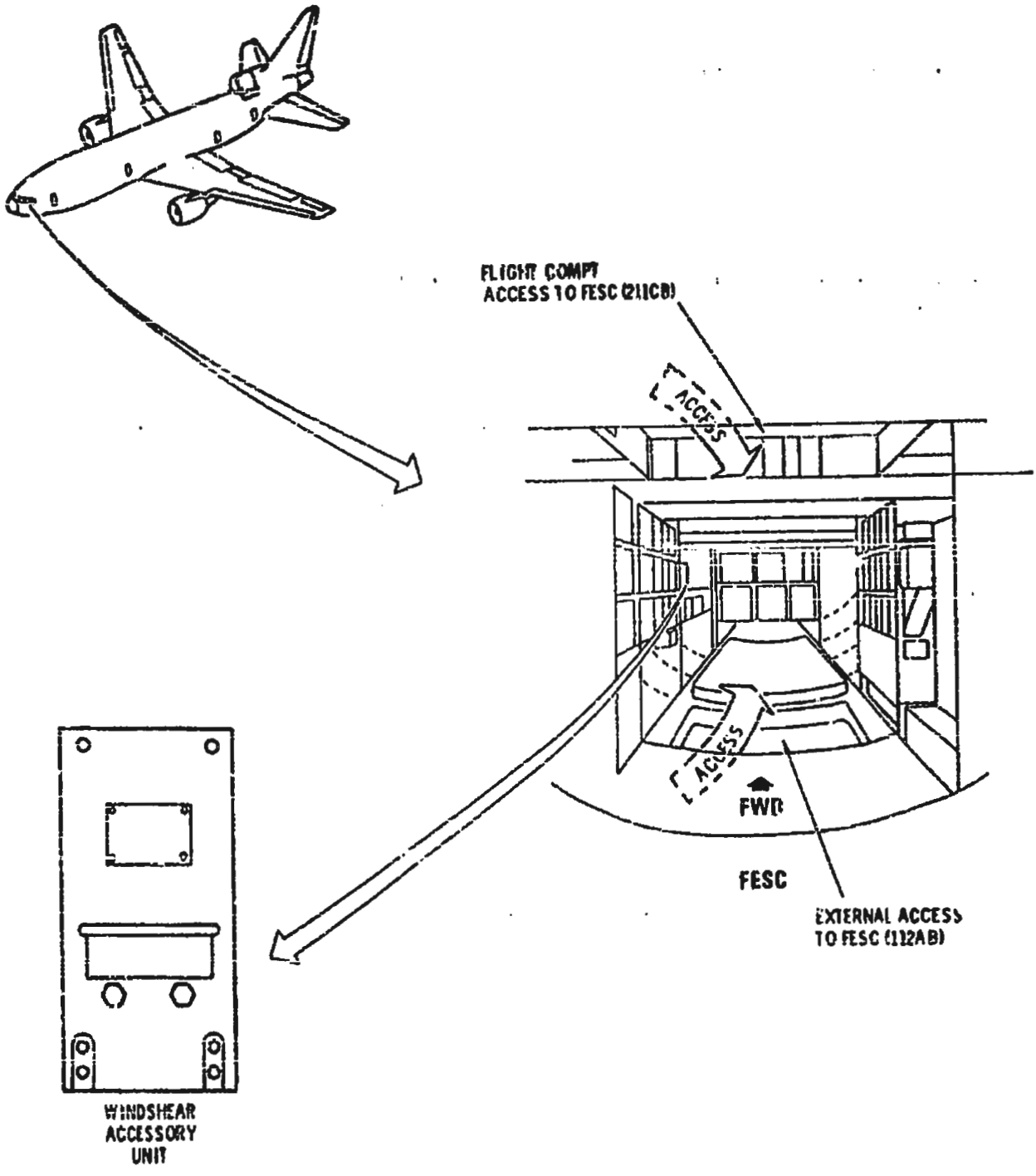
R (a) Fluted knobs slip on their clutch and

R (b) Red band positioned between front of fluted knob
R and dome of hold-down unit is no longer in view.

R (5) Close and secure access door.

R (6) Remove tags and close circuit breakers opened in Step
R 3A(1).

R (7) Perform SELF-TEST procedure on WSAU (Ref. 34-19-00).



MI-0000-34-4710

R Windshear Accessory Unit - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

ATTITUDE AND HEADING - DESCRIPTION AND OPERATION

1. General

The attitude and heading systems are that portion of the navigation system which uses magnetic gyroscopic and inertia forces. The attitude and heading systems consist of the attitude reference system and the magnetic heading reference system (ARS) (MHRS).

C Attitude Reference System (Ref. 34-21-00): (VG Equipped).

Standby horizon indicator (Ref. 34-23-00).

C Attitude Reference System (Ref. 34-43-00):

C (INS Equipped)

C Inertial navigation units and attitude director
C indicator

C Standby horizon indicator (Ref. 34-23-00)

Magnetic Heading Reference System (Ref. 34-22-00):

Directional gyro, flux valve, compass coupler, compass controller, magnetic compensator, horizontal situation indicator (HSI), radio digital distance magnetic indicator (RDDMI) and standby compass.

The attitude reference system interfaces with the following systems: autoflight (AFCS) (Ref. 22-00-00), weather radar (Ref. 34-44-00), central instrument warning (Ref. 34-16-00),
R instrument source selection (Ref. 34-00-01), aircraft integrated
R data system (AIDS) (Ref. 31-32-00), and (on aircraft with
R SB34-178), windshear warning and guidance (Ref. 34-19-00).

The magnetic heading reference system interfaces with the following systems: autoflight (AFCS), VOR (Ref. 34-55-00), ADF (Ref. 34-57-00), central instrument warning, instrument source selection, and aircraft integrated data system (Ref. 31-32-00).

CR MAGNETIC HEADING REFERENCE SYSTEM (MHRS) - MAINTENANCE PRACTICES

CR 1. Maintenance Notes, Tolerances and Regulations

CR A. The permissible amounts of spread between instrument and
CR absolute system tolerances are listed. Any deviation in
CR excess of these amounts must be corrected.

CR (1) Magnetic Compass Accuracy = ± 5°

CR (2) Remote Compass Accuracy = ± 2°

CR (3) Capt HSI card versus F/O HSI Card = ± 2°

CR (4) Capt HSI card versus F/O RDDMI card = ± 2°

CR (5) Capt RDDMI card versus F/O RDDMI card = ± 4°

CR (6) F/O HSI card versus F/O RDDMI card = ± 2°

CR (7) F/O HSI card versus Capt RDDMI card = ± 2°

CR (8) Capt HSI card versus Capt RDDMI card = ± 2°

CR (9) Magnetic Compass versus each HSI card = ± 7°

CR B. Fluxvalve Installation Magnetic Clearances

CR (1) Magnetic materials shall not be installed or attached
CR to the aircraft which will cause magnetic error in the
CR compass systems.

CR (a) No magnetic material (screws and rivets included)
CR shall be installed within 18 inches radius of the
CR fluxvalve.

CR (b) In all instances, the compass shall be observed
CR for induced error when repairs are made near the
CR fluxvalve.

CR C. Magnetic Shipment Procedures

CR (1) Because magnetic shipments can cause compass errors,
CR maintenance personnel should be aware of the
CR regulations regarding magnetic material shipments.

CR (a) Magnetic material is shipped only in the aft area
CR of the aft belly cargo compartment on ALL
CR passenger aircraft.

CR CR (b) No maintenance checks of compasses are required on L-1011 aircraft.

ATTITUDE REFERENCE SYSTEM - DESCRIPTION AND OPERATION

1. General

The attitude reference system (Ref. Fig. 1) provides a stable horizontal reference plane from which aircraft pitch and roll attitudes can be determined. Two identical attitude reference systems are installed in the aircraft. Depending on aircraft configuration, each system consists of either a vertical gyro (VG) or an inertial unit (IU) (Ref. 34-43-00) and an attitude director indicator (ADI). The third vertical gyro on aircraft without INS installed, or inertial navigation unit (Ref. 34-43-00) on aircraft with INS is installed as an alternate in case of failure of either of the other two reference units. Included with the two systems is a single standby horizon indicator. The standby indicator provides the pilots with a separate and independent aircraft pitch and roll reference (Ref. 34-23-00). Whether vertical gyros or inertial systems are installed, operation of the attitude reference system is unchanged. For more detailed information on operation of the inertial systems, refer to 34-43-00.

NOTE: The following description will refer to the three systems as attitude reference system (ARS) No. 1, 2 or 3.

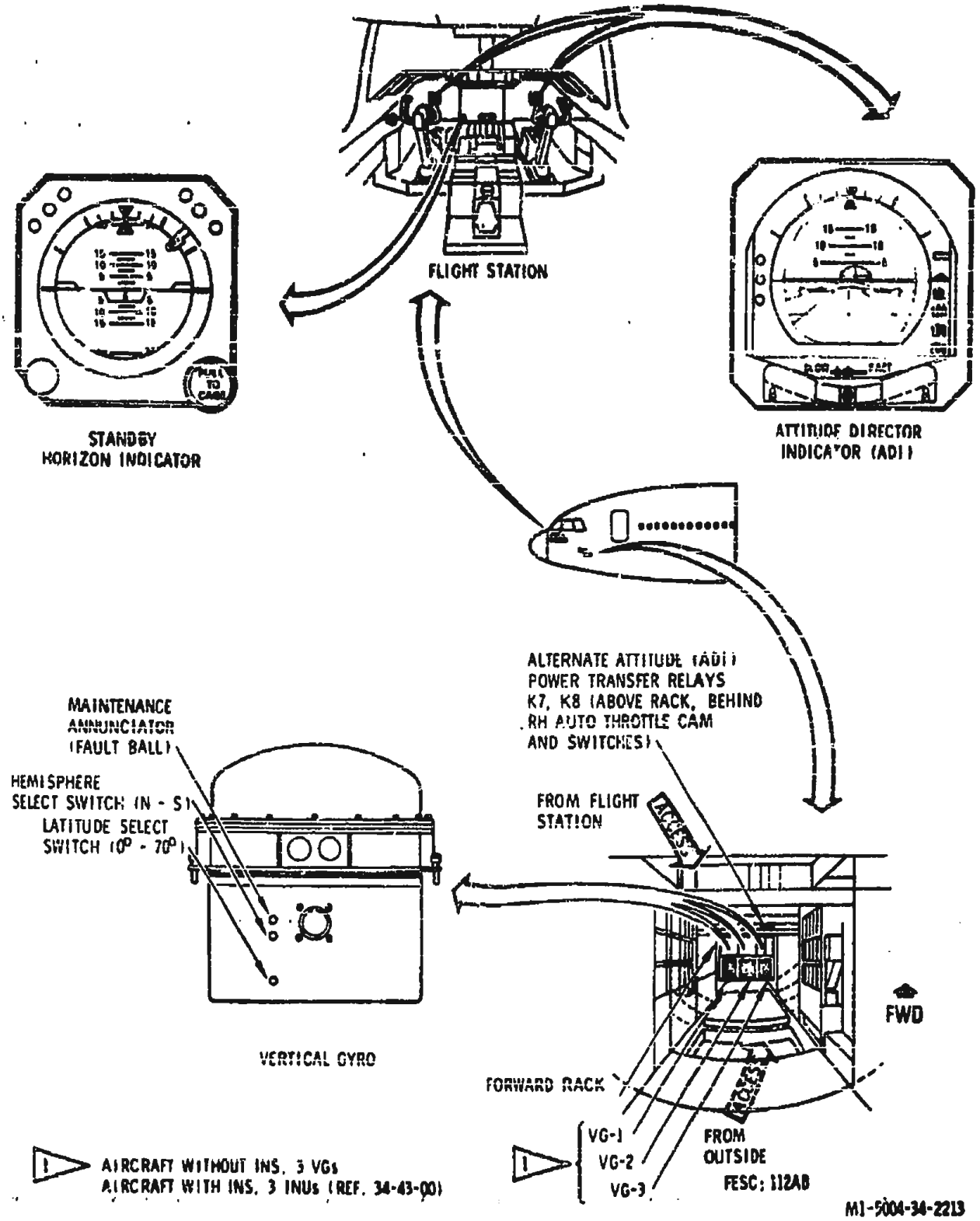
The three attitude reference systems (ARS) are installed in the forward electronics service center, zone 112. An ADI is installed on the Captains instrument panel, zone 211, and on the First Officers instrument panel, zone 212. The standby horizon indicator is installed in the pilots center instrument panel.

The attitude reference systems (Ref. Fig. 2) receive power through circuit breakers on the pilots overhead circuit breaker panel CB1, zone 210.

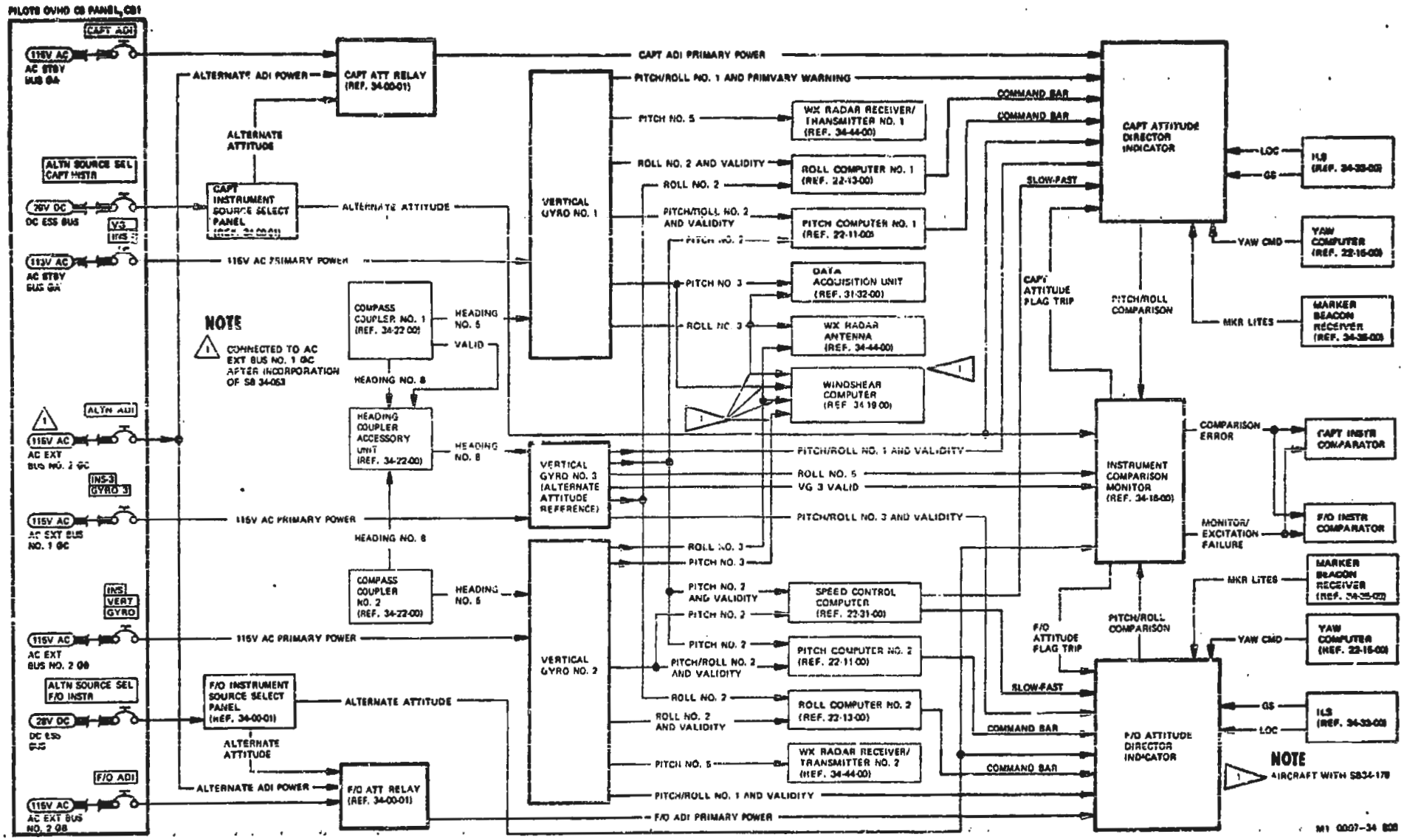
Attitude reference systems No. 1 and No. 2 operate identically. ARS No. 1 provides attitude data to the Captains ADI, and ARS No. 2 provides attitude data to the First Officers ADI.

Both systems provide attitude warning flag holding voltages to the ADIs. In addition, both systems provide attitude data to the weather radar systems (Ref. 34-44-00), the autoflight systems (Ref. 22-00-00), the digital flight data recorder system (Ref. 31-31-00), the aircraft integrated data system (Ref.
R 31-32-00), and (on aircraft with SB34-178) the windshear
R computer (Ref. 34-19-00).

Either ADI can display attitude data from an alternate source which is ARS No. 3. ARS No. 3 is selected on the instrument source selector panels. Either the Captain or the First Officer



Attitude Reference System
Figure 1

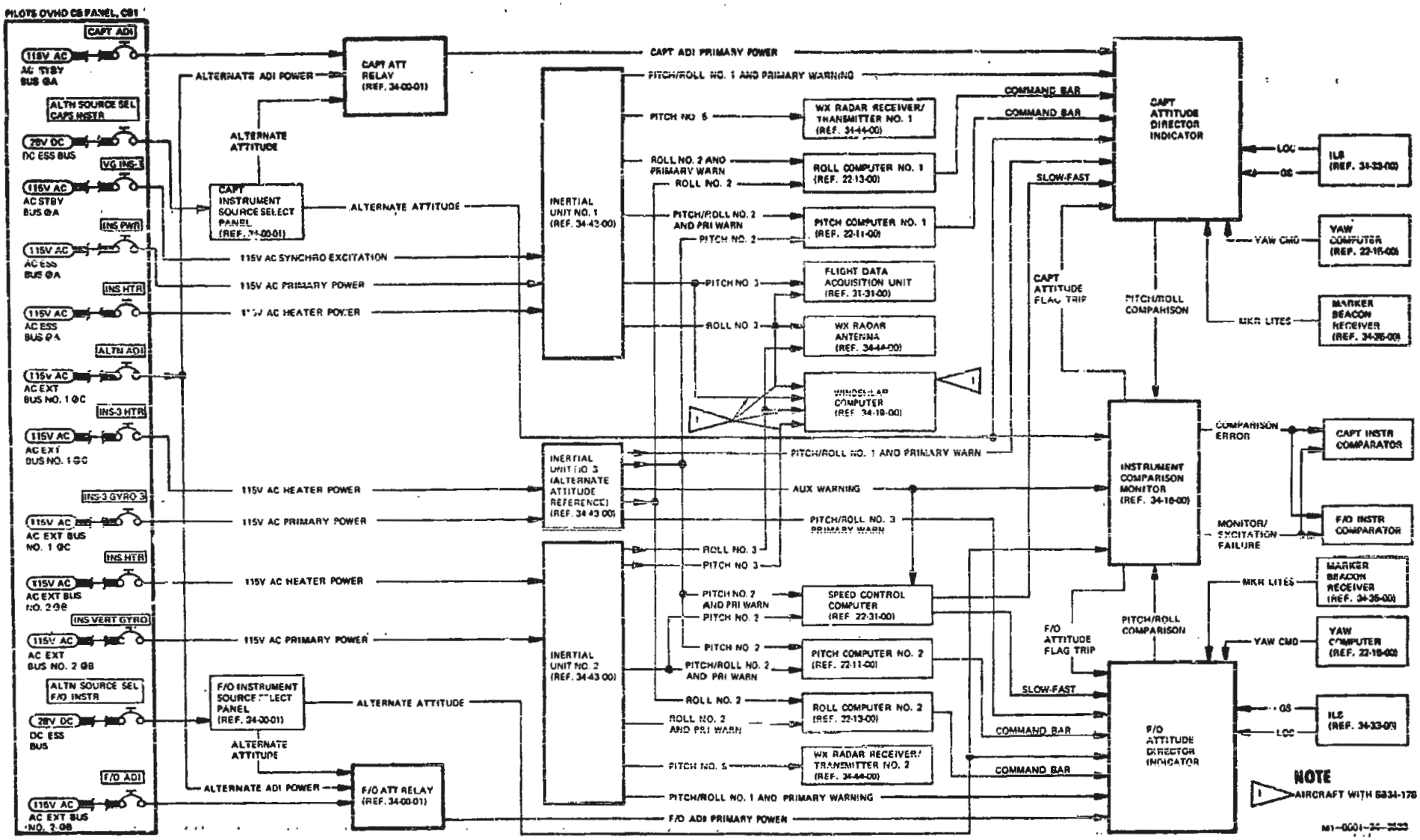


Attitude Reference System Block Diagram
Figure 2 (Sheet 1)

CR
CR

EFFECTIVITY: 001-018

0018



CR Attitude Reference System Block Diagram
CR Figure 2 (Sheet 2)

EFFECTIVITY: 019-999

001B

can select ARS No. 3 by pressing (latching in) the ALTN ATT switchlight on their respective instrument source select panel. ARS No. 3 provides attitude data to the ADIs in place of ARS No. 1 or No. 2.

In normal operation, attitude information from ARS No. 1 and No. 2 is displayed on the Captains and First Officers ADI. If the Captains ALTN ATT switchlight is latched in, relays are energized in the Captains ADI. The relay contacts connect attitude information from ARS No. 3 to drive the Captains ADI. When the First Officers ALTN ATT switchlight is latched in, operation is identical to the Captains ALTN ATT switchlight, except ARS No. 3 attitude information is displayed on the First Officers ADI.

ARS No. 3 can be selected by either pilot simultaneously.

2. Vertical Gyro

NOTE: Not applicable to aircraft with INS installed; refer to 34-43-00 for inertial system description.

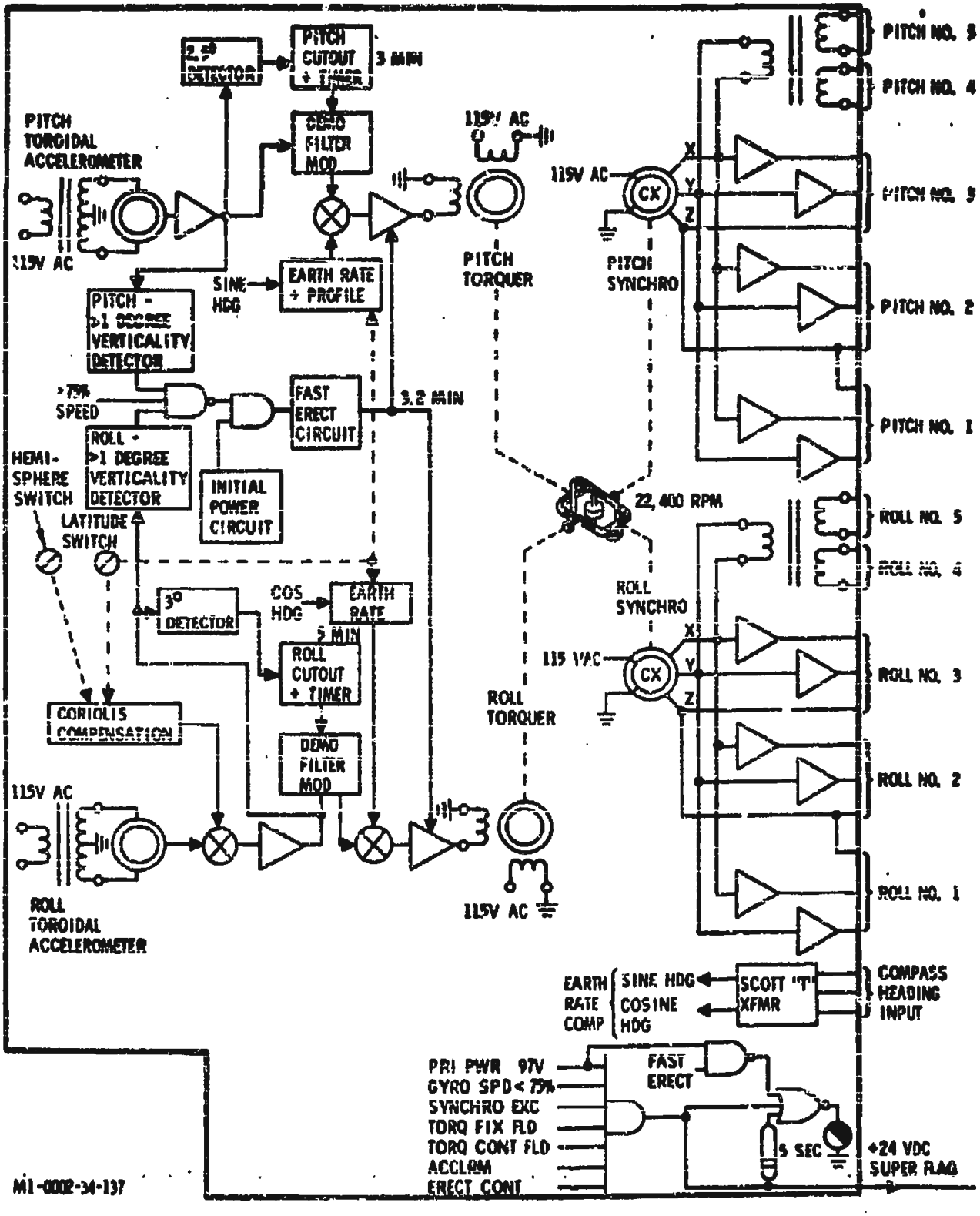
The vertical gyro (VG) provides angular outputs proportional to aircraft attitude pitch and roll displacement from the vertical position. The VG is housed in a metal case. The VG is suspended in a two-axis orthogonal gimbal system providing 360-degrees of freedom in the roll axis and plus or minus 85-degrees in the pitch axis. Internal accelerometers sense deviation from vertical in roll and pitch axes. These signals are processed and applied to torquers to restore the gyro to vertical. The gimbal axes are each provided with one output synchro. A single electrical connector located on the rear of the gyro mount provides system interface. A hemisphere and a latitude switch, along with a fault annunciator are located on the front of the case.

The vertical gyro operates on 115V ac, 400-Hz primary power. The gyro contains its own erection, compensation, monitoring, and attitude (pitch and roll) circuits (Ref. Fig. 3).

Erection

When power is applied to the vertical gyro, the spin axis is random oriented. A fast erection sequence is initiated: When power is applied, when gyro wheel speed is below 75-percent, and when the gyro spin axis is tilted more than 1-degree from vertical in either pitch or roll.

During fast erection, a signal is sent to the gimbal torquer amplifiers to increase their output. Erection



R Vertical Gyro Block Diagram
R Figure 3

EFFECTIVITY: ALL

cutoff is also inhibited, and a warning flag output is provided to the ADIs. The fast erection mode enables the gyro to erect in approximately 3-minutes.

The erection system aligns the vertical gyro to local vertical, and continually corrects for real or apparent gyro drift. The sensor used to determine local vertical is a level-type accelerometer. The accelerometer senses direction of the sum of all accelerations applied to it. One accelerometer is mounted on each gimbal axis (roll and pitch) and detects any tilt in the spin axis away from vertical. The resultant error signals are amplified and applied to gimbal torquers to restore the gyro to vertical.

The gain of the torquer amplifiers is limited to the equivalent of 2.1-degrees per minute in the pitch axis and 1.1-degree per minute in the roll axis. Pitch erection is cut off when the pitch accelerometer output exceeds 0.044G. Roll erection is cut off when the roll accelerometer output exceeds 0.047G. Erection cut-off is timed, and erection voltage is reapplied within 3-minutes for pitch, and 5-minutes for a roll cutoff condition. Erection signals are applied until the error is reduced below the cut-off level. At this time the cut-off circuits are reset allowing the timer to function as before.

Compensation

The vertical gyro is provided with compensating signals for earth rate, earth profile, and coriolis effects.

Earth Rate

The earth rate signal is a constant voltage which is electrically resolved into pitch and roll components. Magnetic heading inputs supplied by the magnetic heading reference system (Ref. 34-22-00) are applied to gimbal torquers to compensate for earth rate of turn.

Earth Profile

A steady-state signal equal to a groundspeed of 480-knots is applied to the pitch gimbal torquer to compensate for earth profile apparent drift.

Coriolis

Latitude, preset by two internal switches, S2 for northern or southern hemisphere operation, and S1

for the nearest 10-degree average latitude; the standard speed (480-knots); and and magnetic heading inputs are used to generate a coriolis acceleration-correcting roll gimbal torquer signal.

Monitor Circuits

Monitoring circuits in the vertical gyro inhibit the ADI superflag voltage (+24V dc) and data valid signals to the autopilots when any one of the following conditions exist:

Primary 115V ac, 400-Hz input power is less than 97-volts

Wheel speed below 75-percent

No accelerometer excitation current

Open winding, slip ring, or connection in the gimbal torquer fixed or control fields, or in the synchro rotors

Failure in fast-erect circuits

A maintenance annunciator in the vertical gyro latches, and indicates by changing from black to yellow, if any of the above conditions is present for 5-seconds after initial erection.

Attitude Outputs

The pitch and roll synchro circuits provide three 3-wire synchro outputs, and two 2- wire synchro outputs of roll and pitch. The synchro outputs are paralleled to provide five pitch and five roll synchro outputs. The outputs are applied to multiple buffer amplifiers to provide the required number of mutually isolated outputs for external equipment.

3. Attitude Director Indicator

A. Description

The attitude director indicators (ADI) (Figures 2 and 4) provide Captain and First Officer with a visual display of aircraft situations. These aircraft situations are: attitude, speed deviation, pitch and roll flight director commands, aircraft orientation during instrument landing (ILS) conditions, takeoff/rollout conditions, radio

altitude, decision height (DH), and marker beacon position. The ADI contains the servomechanisms, meter movements, and power supplies necessary for the various displays. ADI failure warning circuits continuously monitor the attitude, ILS, flight director, speed command, rollout command, and radio altimeter systems. One ADI is clamp-mounted on the Captains instrument panel, zone 211 and the other ADI is clamp-mounted on the First Officers instrument panel, zone 212. System interface is provided through two connectors on the rear of the ADIs.

B. Operation

Primary 115V ac power is applied to the ADI by closing applicable circuit breakers on the pilots overhead circuit breaker panel CB1, zone 210. The ADIs present a pictorial display of aircraft attitude and flight director information on a symbolic three-dimensional, forward view display.

(1) Attitude Display

The basic attitude display consists of a flat, blue and brown calibrated movable attitude tape. This tape, which represents an artificial horizon, is servo driven in both pitch and roll. The attitude tape is read with respect to a fixed aircraft symbol with calibration marks at appropriate pitch angles between 0- and
R 90-degrees up and down (Ref. Fig. 4).

A roll attitude scale at the top of the display and pitch reference marks on the horizon tape provide precise attitude indications. Aircraft attitude is displayed by relationship of the aircraft reference symbol with respect to the movable horizon line.

All servo components for both pitch and roll are contained in the ADI. The three external system inputs used for attitude operation are: three-wire pitch data, three-wire roll data, and 115V ac, 400-Hz power.

A transolver driven by the pitch servo motor provides a pitch servo position feedback signal. A transolver driven by the roll servo motor provides a roll servo position feedback signal.

(2) Flight Director Display

Flight director steering commands are displayed by pitch and roll command bars. The pitch and roll command bars are two yellow inverted V-shaped bars flanking the aircraft symbol. The command bars indicate the amount of pitch and roll command by

relationship of the bars to the fixed aircraft symbol. The command bars move below the aircraft symbol to command pitch down attitude, and move above the aircraft symbol to command pitch up attitude. The command bars tilt right to command roll right, and tilt left to command roll left. The command bars will be biased out of view with loss of flight director validity from the roll (Ref. 22-13-00) and/or pitch (Ref. 22-11-00) computers, or when the flight director is turned OFF. The command bars are controlled by signals originating within the roll computer (Ref. 22-13-00) and pitch computer (Ref. 22-11-00).

(3) Speed Display

Speed deviation is displayed by a speed deviation pointer moving over a horizontal fixed scale at the bottom of the instrument face. The right end of the scale is marked FAST, and the left end is marked SLOW. The speed command signal originates in the speed control computer (Ref. 22-31-00).

The scale is mechanized by a conventional meter mechanism.

(4) Approach Gate Display

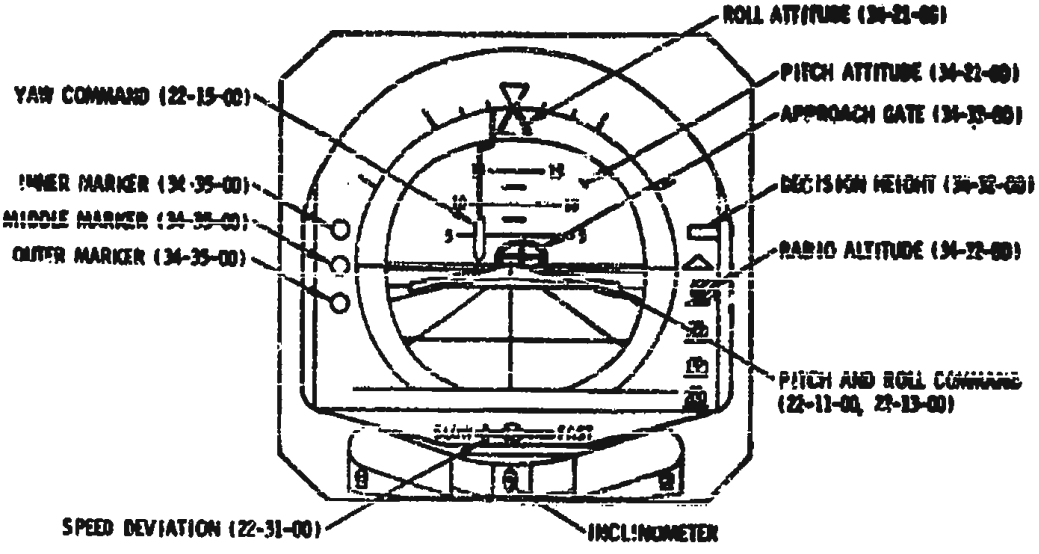
The approach gate is a pink oval-shaped symbol. It indicates aircraft position with respect to the glideslope and localizer beams by relationship of the approach gate to the fixed aircraft symbol. The approach gate is driven vertically by glideslope servos and laterally by localizer servos. These signals originate in the ILS receivers (Ref. 34-33-00).

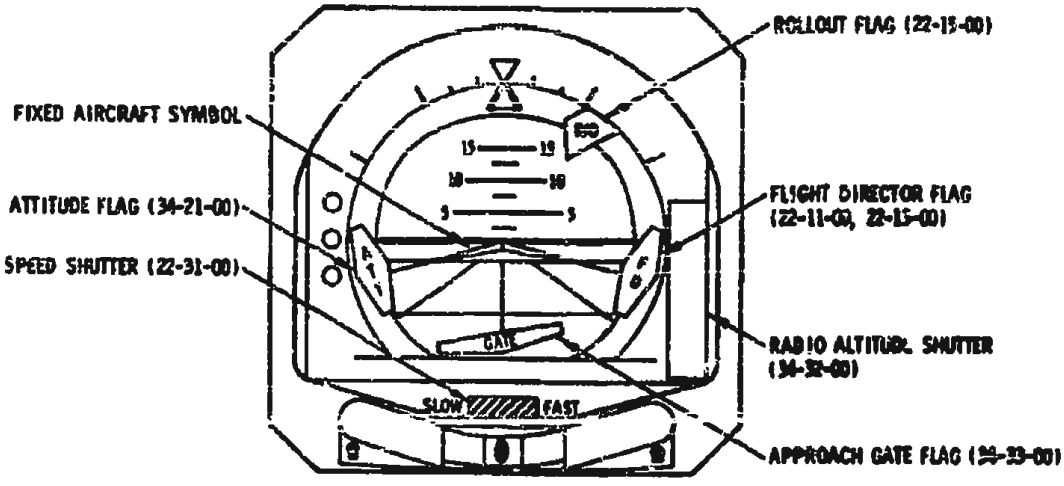
(5) Rollout Command Display

Takeoff/rollout command signals are displayed by a yellow vertical yaw pointer referenced to the center of the aircraft symbol and driven by a servo. The pointer moves right to command steer (yaw) right, and left to command steer (yaw) left. The rollout pointer is biased out of view when the aircraft is airborne. This signal originates in the yaw computer (Ref. 22-15-00).

(6) Radio Altitude Display

The radio altitude pointer is located on the lower right side of the indicator and moves up and down over a fixed scale from 200- to 0-feet (Ref. 34-32-00) and is a conventional meter mechanism.





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Attitude Director Indicator
Figure 4

(7) DH Indication

The decision height (DH) indicator (pink light) is located above the radio altitude scale. It comes on with the radio altitude indicator DH light at the radio altitude indicator preset altitude during the landing phase from an altitude signal originating in the radio altimeter.

(8) Marker Lights

The three marker beacon lights are located on the left side of the indicator and come on to indicate when the aircraft has passed over a marker beacon cone. These signals originate within the marker beacon receivers (Ref. 34-35-00).

(9) Inclinometer

The inclinometer is a ball in a curved liquid-filled tube at the bottom of the instrument bezel. It displays aircraft slip and skid information for aid in coordinating turns. The inclinometer, which is externally adjustable over a range of ±3-degrees, is capable of operating when tilted up to a maximum of 21-degrees.

NOTE: See adjustment procedure in 34-21-07, ADI Removal and Installation.

(10) Warning Flags

(a) Attitude (ATT)

The attitude failure flag (ATT) is biased out of view by a valid signal from the attitude reference systems and controlled by an internal monitor which brings the flag into view if any of the following conditions exist:

- Absence of primary power
- Failure of internal power supply
- Absence of three wire inputs to pitch or roll servos with subsequent loss of sensed excitation (cosine winding) output
- Open circuit in either pitch or roll transolver null (sine) winding

- Presence of persistent excessive servo null in either servo
- Absence of attitude valid input signal
- A first attitude comparison warning signal from the Instrument Comparison Monitor (ICM)

(b) Flight Director (FD)

The flight director (FD) warning flag is biased out of view by an internal dc voltage and controlled by an internal monitor bringing the flag into view if any of the following conditions exist:

- Absence of primary power
- Absence of FD valid signal from the roll and/or pitch computers with flight director ON
- Failure of internal power supply
- Presence of persistent excessive null in Command bar servo
- Failed command bar servo

(c) Approach Gate

The Gate failure flag comes into view when ADI gate servo is invalid, or with loss of primary or internal power supplies

(d) Speed

The speed (SPEED) command warning flag is biased out of view by the presence of the speed control valid signal from the speed control computer, the flag comes into view with loss of speed control validity.

(e) Radio Altitude

The radio altitude shutter will be in view unless radio altitude validity and a 200- foot trip are present (Ref. 34-32-00).

(f) Rollout (R/O)

The rollout (R/O) failure flag comes into view when the ADI rollout servo is invalid and there is a loss of primary or internal power.

4. Flight Director Source Selection

In normal operation, the Captains ADI displays flight director information from Auto Flight System Channel A and the First Officers ADI displays flight director information from Auto Flight System Channel B. The Captain or First Officer may select an alternate channel by latching in the ALTN FLT DIR switchlight. When the ALTN FLT DIR switchlight is latched in, relays in the heading coupler accessory unit are energized. The relay contacts switch the flight director information displayed, from channel A or B as applicable (Ref. 22-10-00, 34-00-01).

4. To Operate System

There are no ON-OFF switches, the system is operational when the aircraft electrical buses are energized and the appropriate attitude reference unit, ADI and standby horizon indicator circuit breakers are pushed in.

To shut down system pull-out the appropriate circuit breakers.

ATTITUDE REFERENCE SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If flight crew reports a trouble using a FIRM fault code, the code can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Supplemental Data

The Attitude Reference System consists of vertical gyros (VG) and/or inertial units (Ref. 34-43-00).

R They are located on bottom shelf of forward rack in FESC, zone
R 112. They are line replaceable units (LRU).

NOTE: For additional Attitude Reference System faults, refer to Inertial System fault isolation (Ref. 34-43-00).

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide Attitude Reference System and associated component locations.

Fault Isolation Diagrams and Schematics List
Table 101

R	FIGURE	TITLE
	101	Component Location Index
	102	Component Locator Diagram
R	103	Standby Horizon Indicator Problems
R	104	ADI Disagreement Problems - ATT Flag in View
R	105	Attitude Problems with One ADI Selected to Alternate
R	106	Vertical Gyro 3 Light ON
	107	ADI Problems
	SCHEM 1 (Sheet 1)	Attitude Reference System Schematic (No. 1 System)
	SCHEM 1 (Sheet 2)	Attitude Reference System Schematic (No. 2 System)
	SCHEM 2 (Sheet 1)	Attitude Reference System Schematic (No. 1 and No. 2 Interface)
	SCHEM 2 (Sheet 2)	Attitude Reference System Schematic (No. 3 System Interface)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
GYRO - VERTICAL 1	3	FESC, FWD RACK 112AB	34-21-04
INDICATOR - ATTITUDE DIRECTOR	2	FLT STA, CAPT AND F O INSTR PNL	34-21-07
INDICATOR - STANDBY HORIZON	1	FLT STA, CTR INSTR PNL	34-21-08
RELAY - ADI POWER TRANSFER	2	FESC, ABOVE FWD RACK 112AB	20-24-01
UNIT INERTIAL NAVIGATION 2	3	FESC, FWD RACK/112AB	34-43-03

EFFECTIVITY

1 AIRCRAFT WITHOUT INS

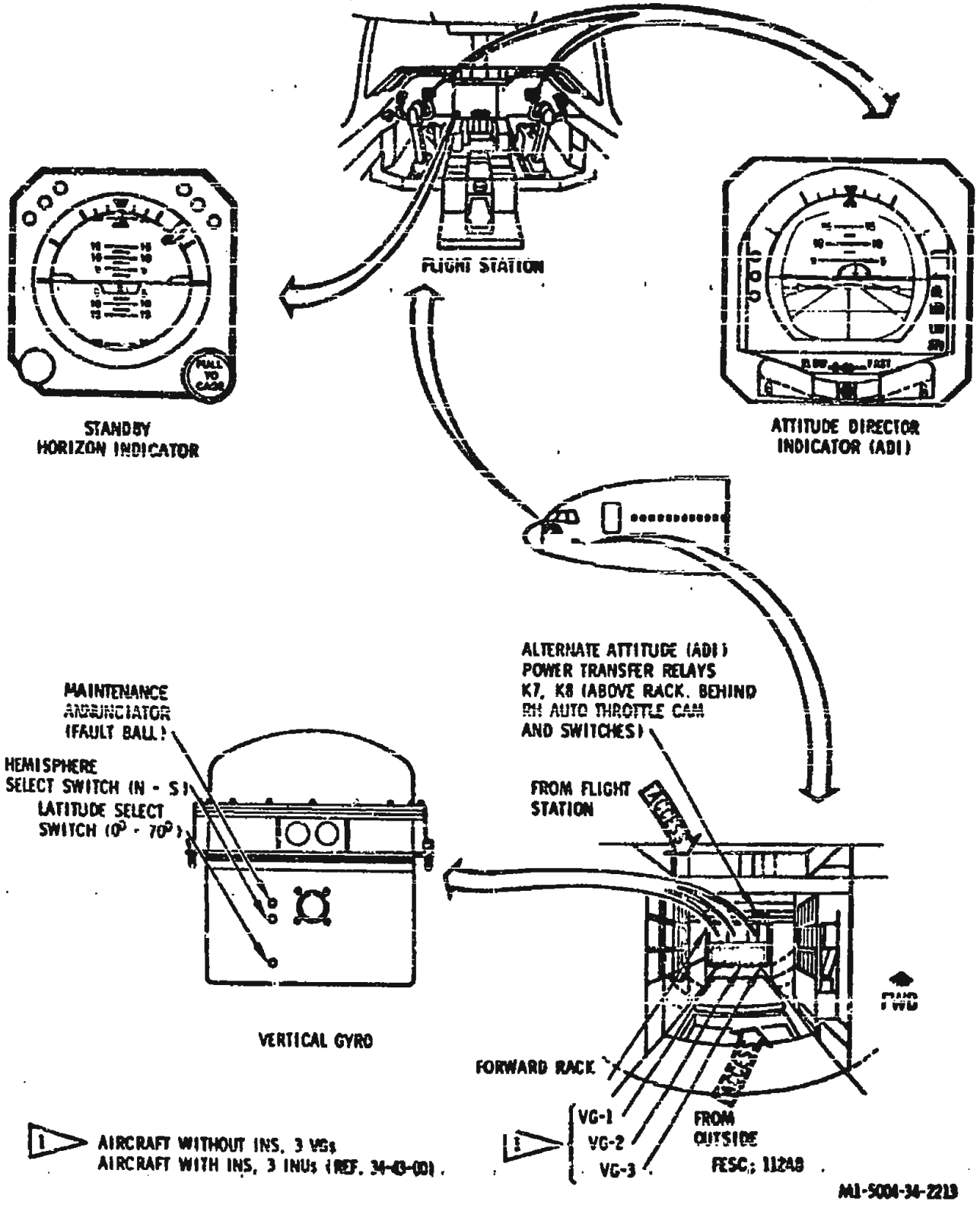
2 AIRCRAFT WITH INS

M1-5000-34-331B

R R Component Location Index
Figure 101

R R EFFECTIVITY: ALL

001B



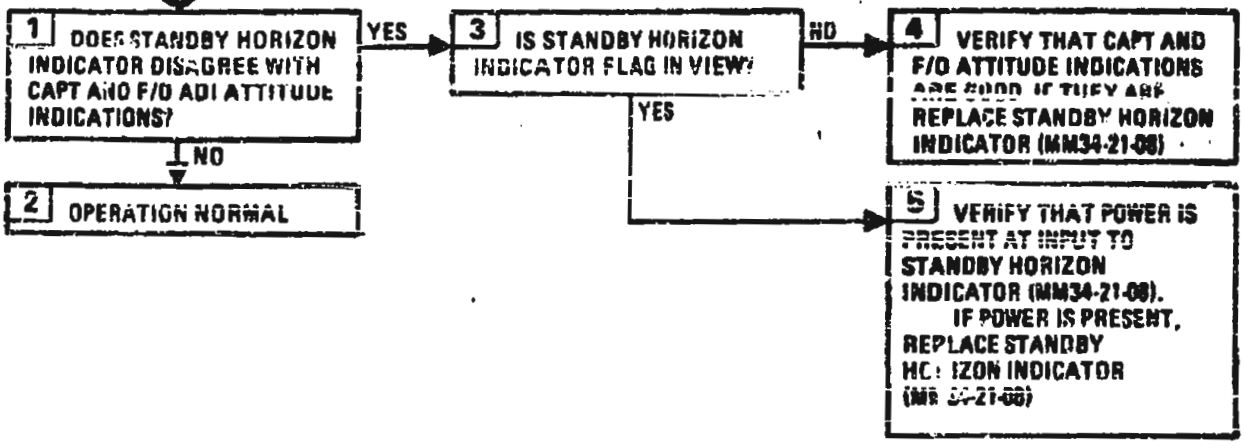
R R Component Locator Diagram
Figure 102

R R EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR–FWD, MID AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D9, 1D26, 1D27, 1E1, 1E2, 1E5, 1E6, 1E7, 1E18, 1E24, 1E25, 1F2, 1F6, 1F7, 1F20, 1G6, 1G24, 1G25, 2A21
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
ENSURE THAT ATTITUDE REFERENCE SYSTEMS ARE OPERATING

STANDBY HORIZON INDICATOR PROBLEMS


1 DOES STANDBY HORIZON INDICATOR DISAGREE WITH CAPT AND F/O ADI ATTITUDE INDICATIONS?
YES
3 IS STANDBY HORIZON INDICATOR FLAG IN VIEW?
NO
4 VERIFY THAT CAPT AND F/O ATTITUDE INDICATIONS ARE GOOD. IF THEY ARE, REPLACE STANDBY HORIZON INDICATOR (MM34-21-08)
NO
2 OPERATION NORMAL
YES
5 VERIFY THAT POWER IS PRESENT AT INPUT TO STANDBY HORIZON INDICATOR (MM34-21-08). IF POWER IS PRESENT, REPLACE STANDBY HORIZON INDICATOR (MM34-21-08)

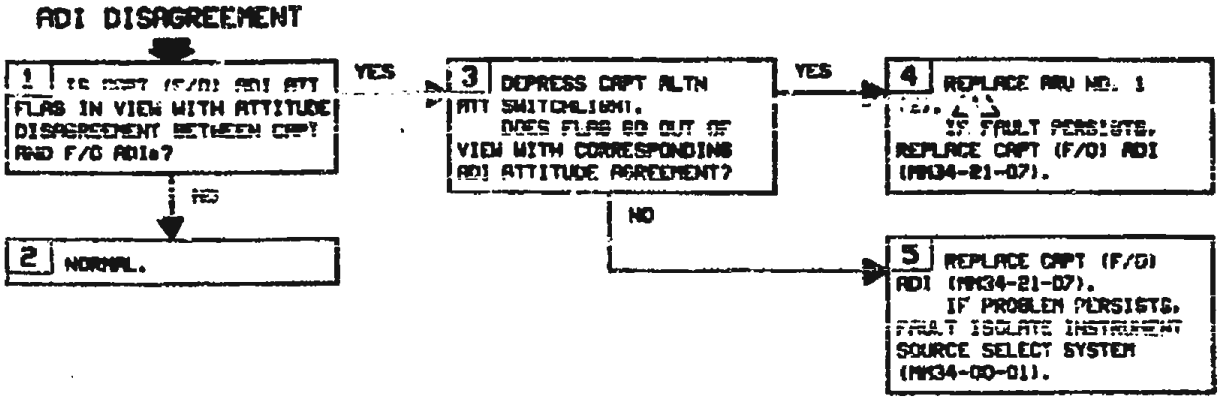
NOTE
1 TURN INERTIALS OFF AT CONCLUSION OF TESTING TO PREVENT POSSIBLE DISCHARGE OF INERTIAL BATTERIES

M1–0003–34–077

R
R

Standby Horizon Indicator Problems
Figure 103

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D26, 1E1, 1E2, 1F5, 1E6, 1E7, 1E9, 1E24, 1E25, 1F2, 1F6, 1F26, 1B6, 1B24, 1B25, 2R21
ATT SWITCHLIGHT ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
ENSURE THAT ALL ATTITUDE SYSTEMS ARE OPERATING


ADI DISAGREEMENT
1 IS CAPT (F/O) ADI ATT FLAG IN VIEW WITH ATTITUDE DISAGREEMENT BETWEEN CAPT AND F/O ADIs?
YES
NO
2 NORMAL.
3 DEPRESS CAPT ALTN ATT SWITCHLIGHT. DOES FLAG GO OUT OF VIEW WITH CORRESPONDING ADI ATTITUDE AGREEMENT?
YES
NO
4 REPLACE ARU NO. 1 (1) IF FAULT PERSISTS, REPLACE CAPT (F/O) ADI (MM34-21-07).
5 REPLACE CAPT (F/O) ADI (MM34-21-07). IF PROBLEM PERSISTS, FAULT ISOLATE INSTRUMENT SOURCE SELECT SYSTEM (MM34-00-01).

NOTE

TURN INERTIAL SYSTEMS OFF AT CONCLUSION OF TESTING TO PREVENT POSSIBLE DISCHARGE OF INERTIAL BATTERIES

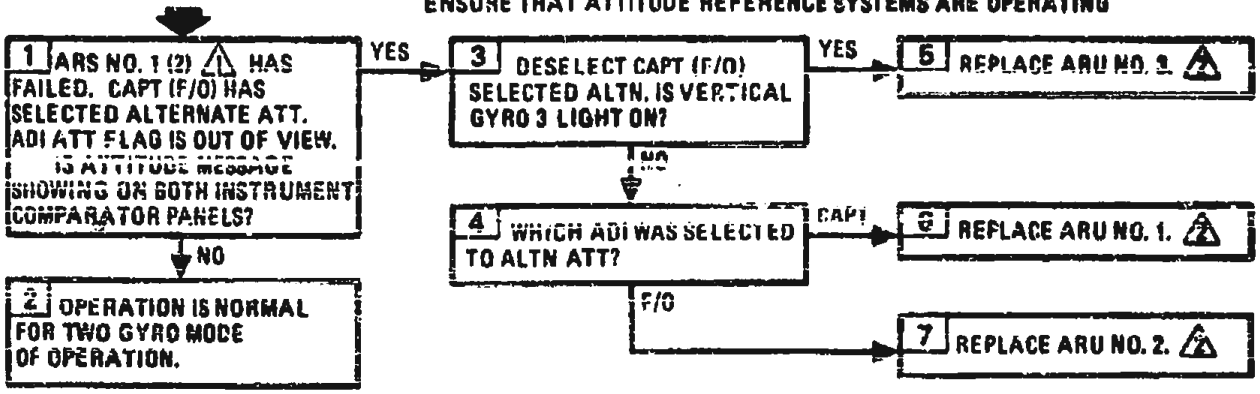
(1) ARU = ATTITUDE REFERENCE UNIT
INERTIAL UNIT (MM34-43-03) OR VERTICAL GYRO (MM34-21-04)

M1-0001-34-2030

R R ADI Disagreement Problem - ATT Flag in View
Figure 104

PREREQUISITES

ELECTRICAL POWER (MM34-00-00)
COOLING: VERIFY AVIONIC AIR–FWD, MID, AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D9, 1D26, 1D27, 1E1, 1E2, 1E19, 1E24, 1F2, 1F5, 1F6, 1G8, 1G24, 1K20, 2A21
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
ENSURE THAT STANDBY HORIZON INDICATOR IS OPERATING
ENSURE THAT ATTITUDE REFERENCE SYSTEMS ARE OPERATING


ATTITUDE PROBLEMS WITH ONE ADI SELECTED TO ALTN
1 ARS NO. 1 (2) ⚠1 HAS FAILED. CAPT (F/O) HAS SELECTED ALTERNATE ATT. ADI ATT FLAG IS OUT OF VIEW. IS ATTITUDE MESSAGE SHOWING ON BOTH INSTRUMENT COMPARATOR PANELS?
YES
NO
2 OPERATION IS NORMAL FOR TWO GYRO MODE OF OPERATION.
3 DESELECT CAPT (F/O) SELECTED ALTN. IS VERTICAL GYRO 3 LIGHT ON?
YES
NO
5 REPLACE ARU NO. 1 ⚠2
4 WHICH ADI WAS SELECTED TO ALTN ATT?
CAPT
F/O
6 REPLACE ARU NO. 1. ⚠2
7 REPLACE ARU NO. 2. ⚠2

NOTE

TURN INERTIALS OFF AT CONCLUSION OF TESTING TO PREVENT POSSIBLE DISCHARGE OF INERTIAL BATTERIES

⚠1 ARS = ATTITUDE REFERENCE SYSTEM

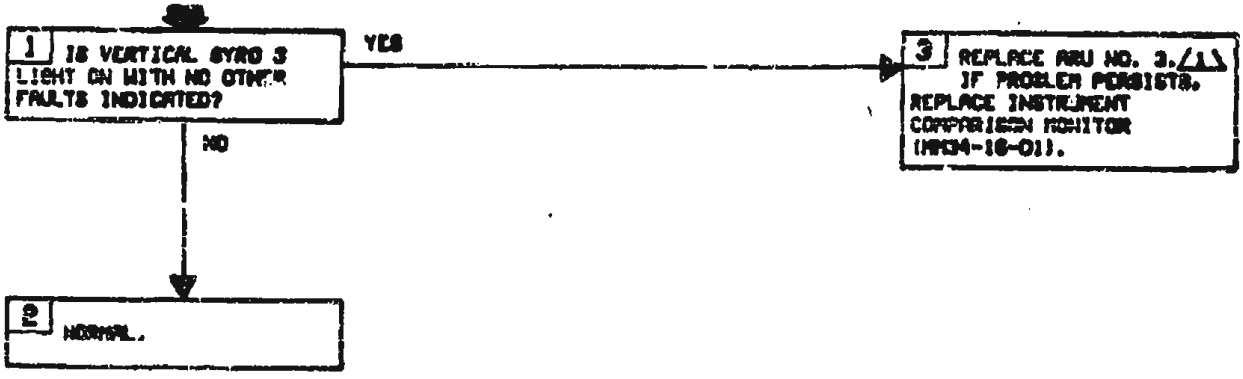
⚠2 ARU = ATTITUDE REFERENCE UNIT
INERTIALS (MM34-43-03) OR VERTICAL GYRO(S) (MM34-21-04)

M1-0005-34-1725

R R Attitude Problems with One ADI Selected to Alternate
Figure 105

VS 3 LIGHT ON

PREREQUISITES
ELECTRICAL POWER (MM24-30-00).
COOLING: VERIFY AVIONIC AIR-FWD, MID, AND INB COOLING LO FLO LIGHTS ON FE/SD ECS MONITOR PANEL ARE OUT.
CB'S: 1D8, 1D88, 1E1, 1E2, 1E6, 1E7, 1E19, 1E84, 1F2, 1F8, 1F20, 186, 1824, 1825, SR21.
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED.
ENSURE THAT ALL ATTITUDE SYSTEMS ARE OPERATING.


1 IS VERTICAL GYRO 3 LIGHT ON WITH NO OTHER FAULTS INDICATED?
YES
NO
3 REPLACE ARU NO. 3. (1)
IF PROBLEM PERSISTS, REPLACE INSTRUMENT COMPARISON MONITOR (MM34-18-01).
2 NORMAL.

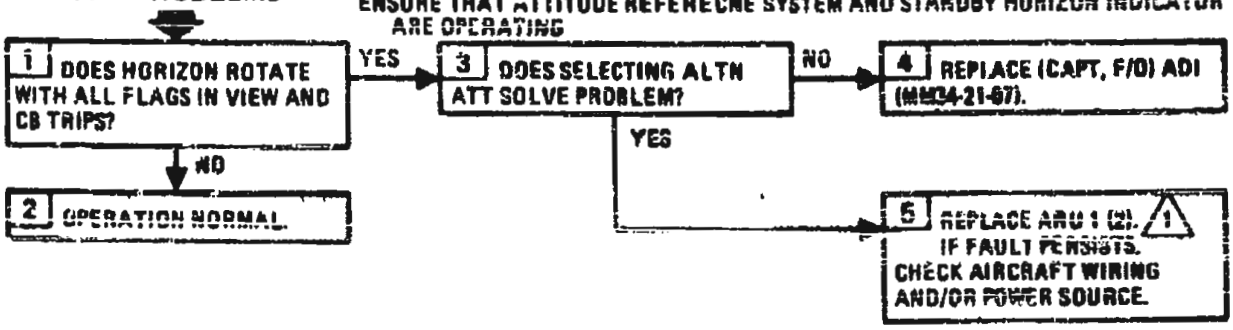
NOTE
TURN INERTIALS OFF AT CONCLUSION OF TESTING TO PREVENT POSSIBLE DISCHARGE OF INERTIALS BATTERIES.

(1) ARU = ATTITUDE REFERENCE UNIT. INERTIAL UNIT (MM34-43-00) OR VERTICAL GYRO (MM34-21-04).

R
R

Vertical Gyro 3 Light ON
Figure 106

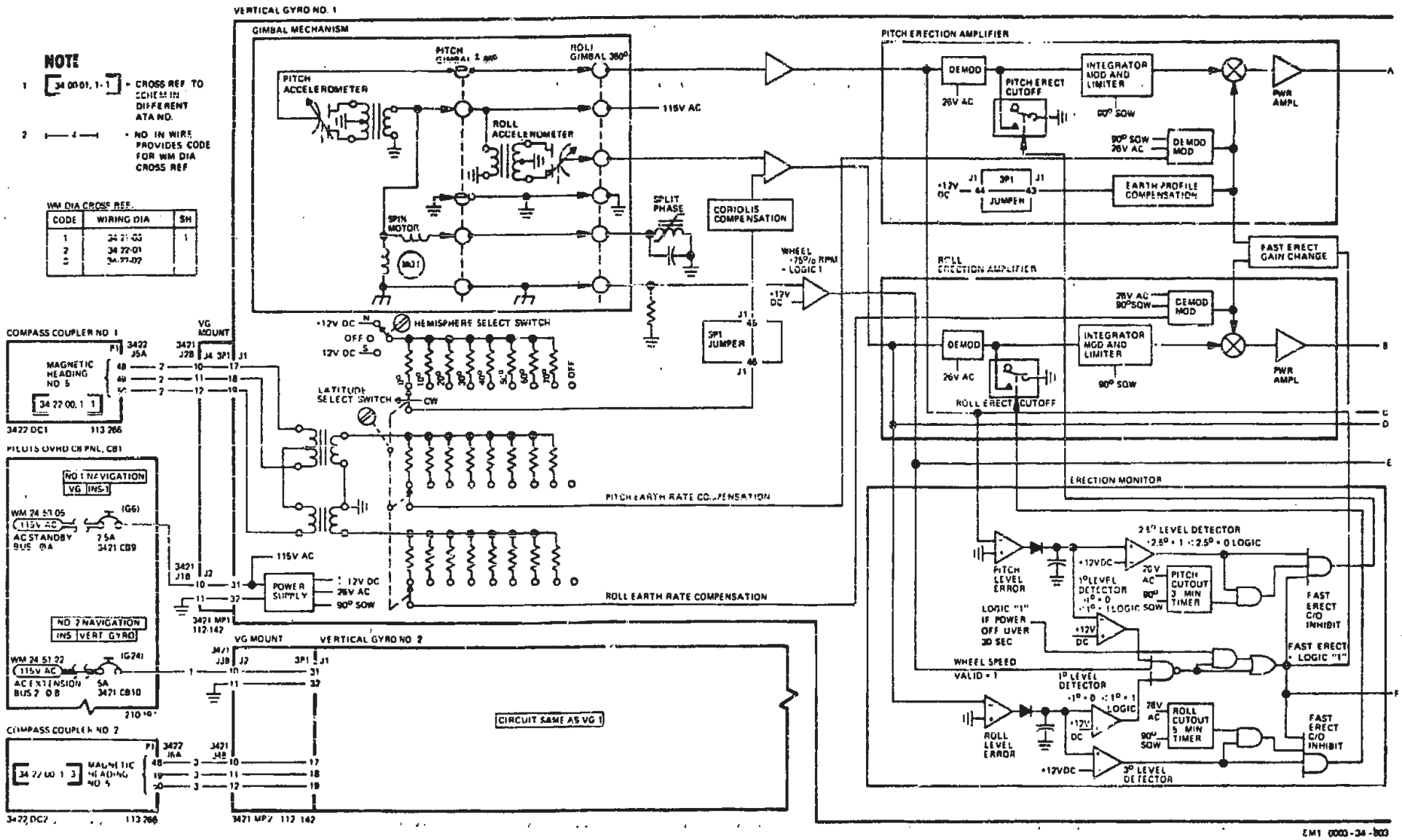
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR—FWD AND MID LOW FLO LIGHTS ON F/E/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D9, 1D26, 1D27, 1E1, 1E2, 1E19, 1E24, 1F2, 1F5, 1F6, 1F20, 1G6, 1G24, 1K20, 1K23, 2A21
ALL SWITCHLIGHTS ON BOTH INSTRUMENT SOURCE SELECT PANELS RELEASED
ENSURE THAT ATTITUDE REFERECNE SYSTEM AND STANDBY HORIZON INDICATOR ARE OPERATING


ADI PROBLEMS
1 DOES HORIZON ROTATE WITH ALL FLAGS IN VIEW AND CB TRIPS?
YES
3 DOES SELECTING ALTN ATT SOLVE PROBLEM?
NO
4 REPLACE (CAPT, F/O) ADI (MM34-21-67).
NO
2 OPERATION NORMAL.
YES
5 REPLACE ARU 1 (2). IF FAULT PERSISTS, CHECK AIRCRAFT WIRING AND/OR POWER SOURCE.
1

1 NOTE
ARU = ATTITUDE REFERENCE UNIT
INERTIAL UNIT (MM34-43-03) VERTICAL GYRO (MM34-21-04)

M1-0001-34-3036

ADI Problems
Figure 107



NOTE

1 [34 00 01, 1-1] = CROSS REF TO SCHEM IN DIFFERENT ATA NO.

2 —4— = NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF

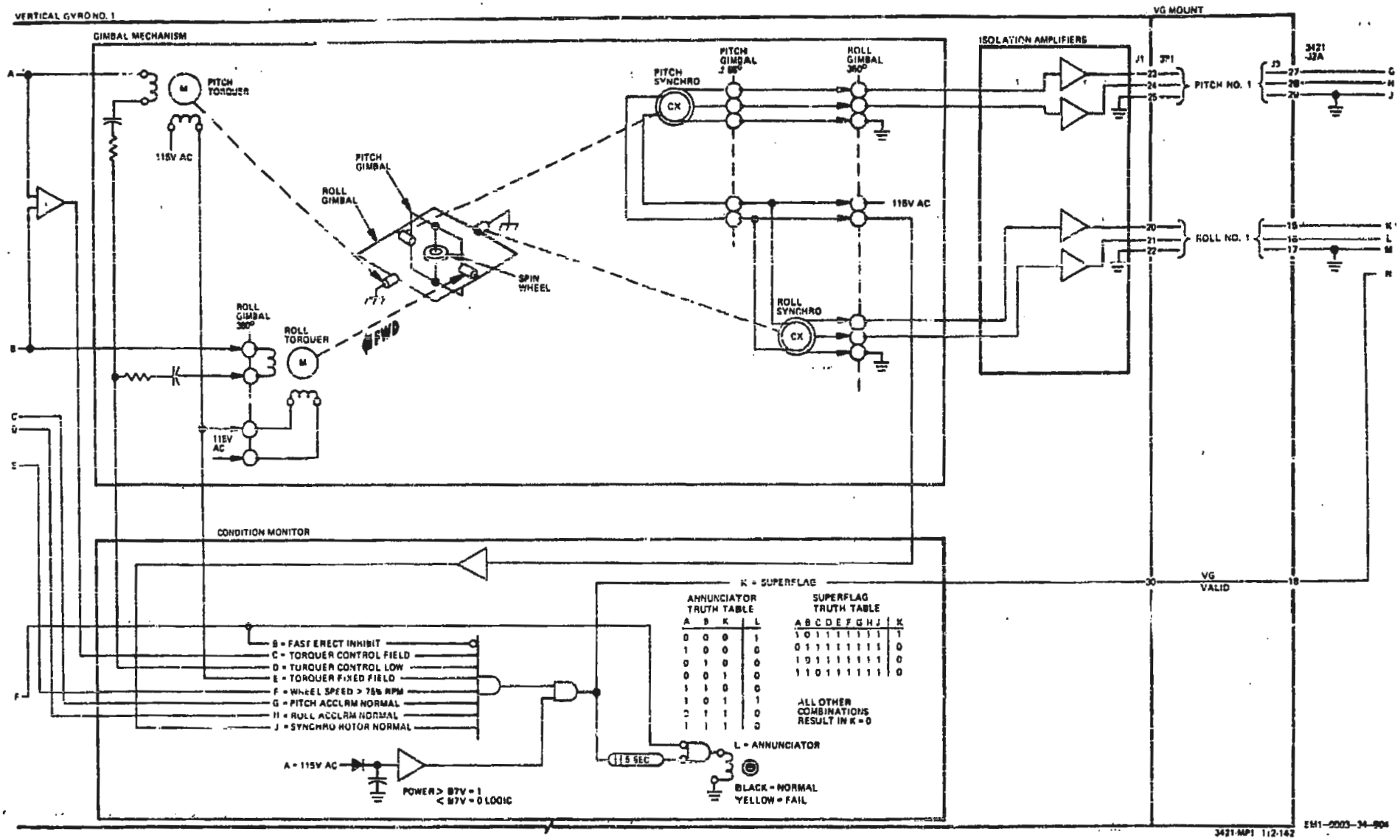
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	34 21 03	1
2	34 22 01	
3	34 21 02	

R Attitude Reference System Schematic (No. 1 System)
R SCHEM 1 (Sheet 1)

EFFECTIVITY: A/C WITHOUT INS

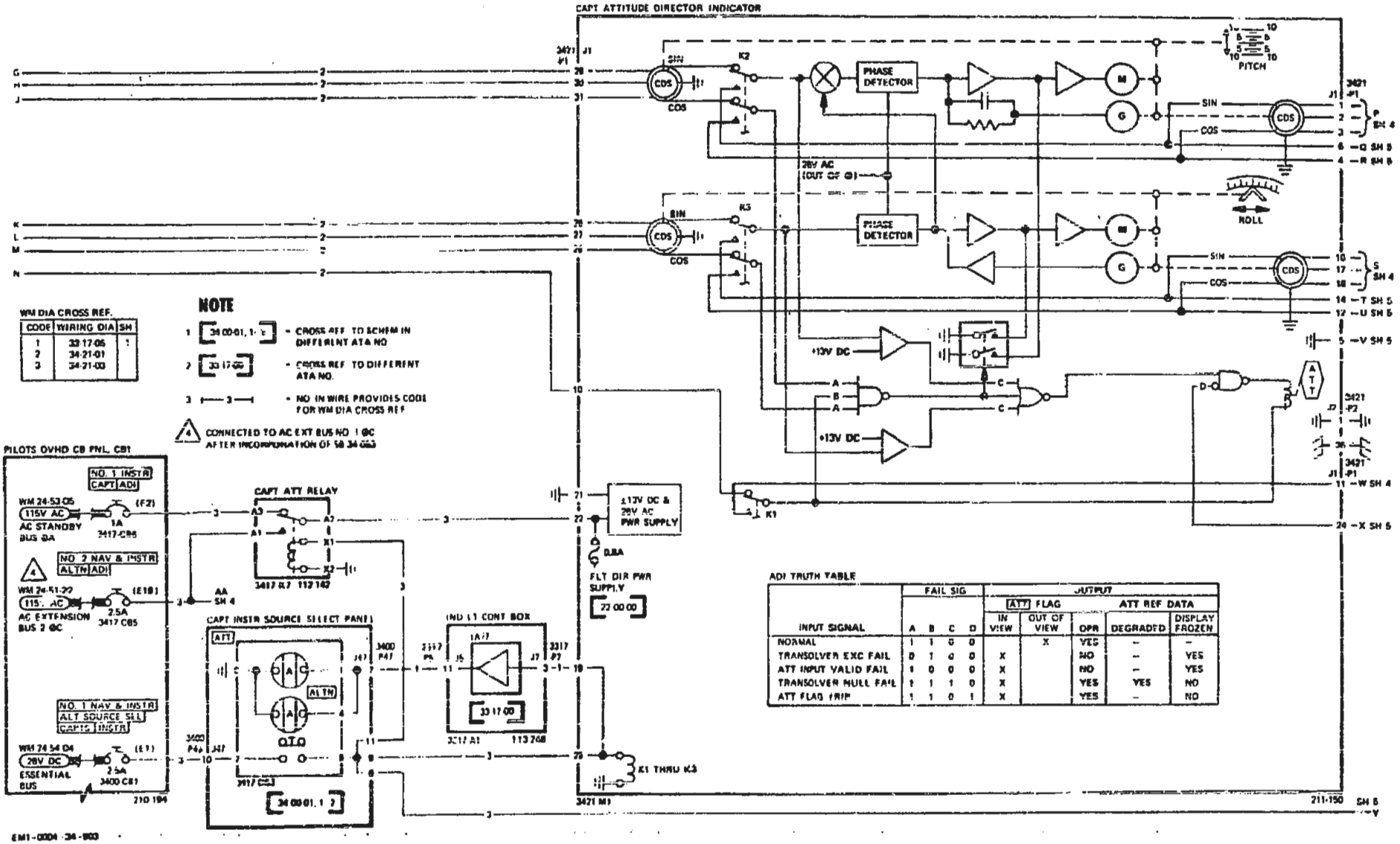
001B



R Attitude Reference System Schematic (No. 2 System)
R SCHEM 1 (Sheet 2)

EFFECTIVITY: A/C WITHOUT INS

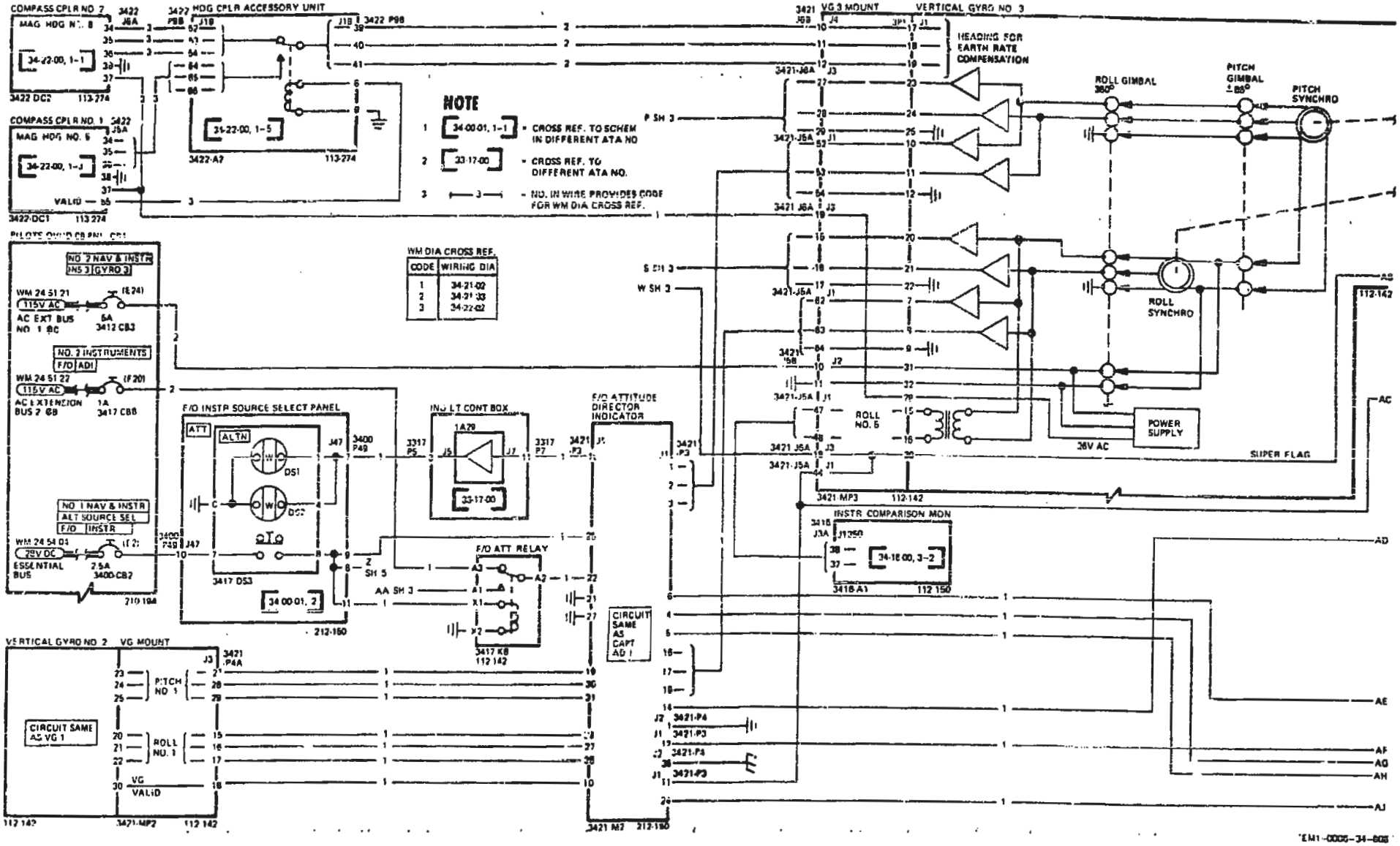
001B


CAPT ATTITUDE DIRECTOR INDICATOR
PHASE DETECTOR
PITCH
ROLL
SIN
COS
28V AC (OUT OF Ø)
+13V DC
±13V DC & 28V AC PWR SUPPLY
FLT DIR PWR SUPPLY
CAPT ATT RELAY
CAPT INSTR SOURCE SELECT PANEL
IND LT CONT BOX
PILOTS OVHD CB PNL, CB1
NO. 1 INSTR CAPT ADI
NO 2 NAV & INSTR ALTN ADI
NO. 1 NAV & INSTR ALT SOURCE SEL CAPTS INSTR
AC STANDBY BUS ØA
AC EXTENSION BUS 2 ØC
ESSENTIAL BUS
K1 THRU K3
NOTE
CONNECTED TO AC EXT BUS NO 1 ØC AFTER INCORPORATION OF SB 34-053
WM DIA CROSS REF.
CODE WIRING DIA SH
1 33-17-05 1
2 34-21-01
3 34-21-03
CROSS REF TO SCHEM IN DIFFERENT ATA NO
CROSS REF TO DIFFERENT ATA NO.
NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
ADI TRUTH TABLE
INPUT SIGNAL
FAIL SIG A B C D
OUTPUT ATT FLAG IN VIEW OUT OF VIEW OFF
ATT REF DATA DEGRADED DISPLAY FROZEN
NORMAL 1 1 0 0 X YES – –
TRANSOLVER EXC FAIL 0 1 0 0 X NO – YES
ATT INPUT VALID FAIL 1 0 0 0 X NO – YES
TRANSOLVER NULL FAIL 1 1 1 0 X YES YES NO
ATT FLAG TRIP 1 1 0 1 X YES – NO

R Attitude Reference System Schematic (CAPT ADI)
R SCHEM 1 (Sheet 3)

EFFECTIVITY: A/C WITHOUT INS

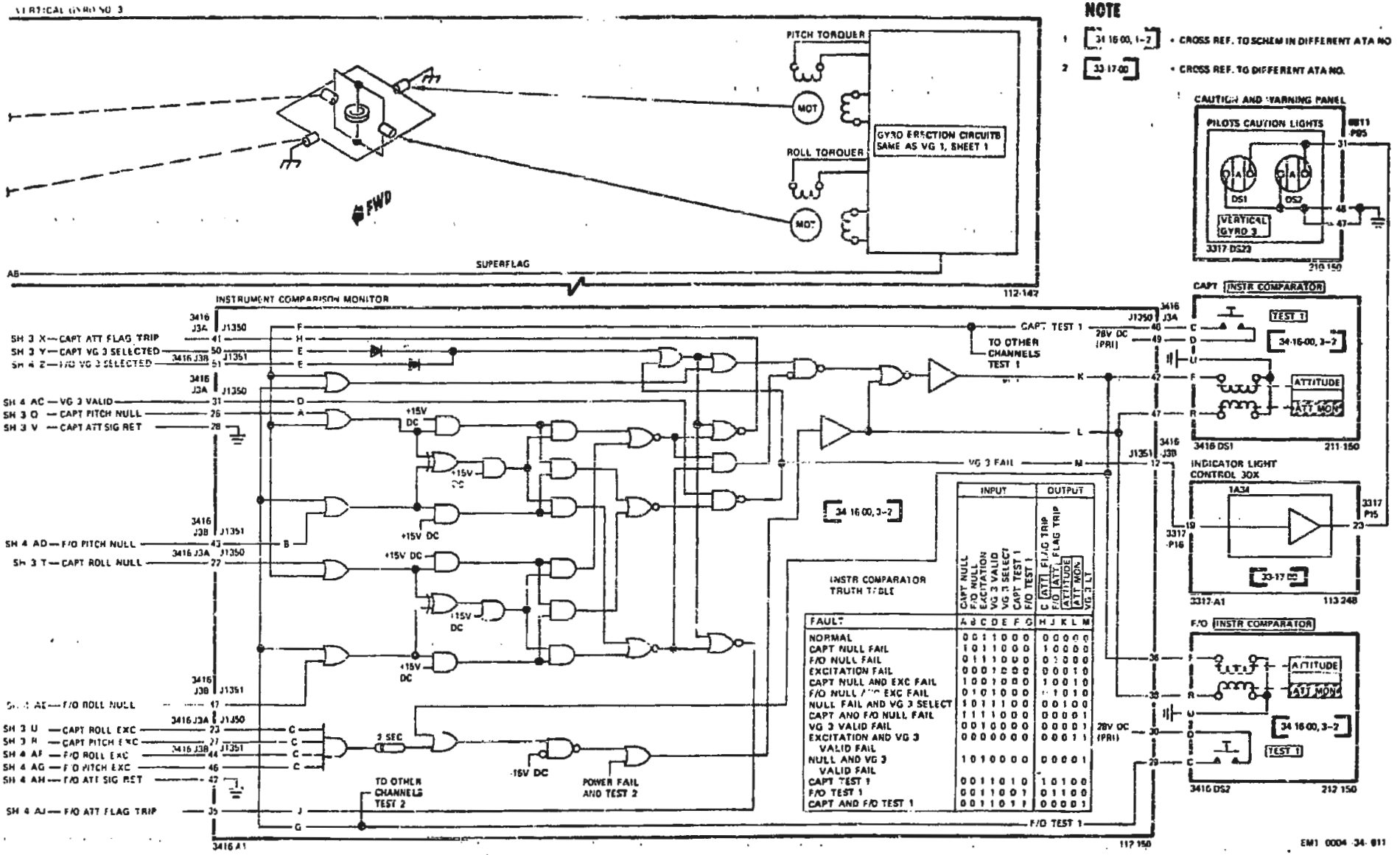
001B



R Attitude Reference System Schematic (F/O ADI)
R SCHEM 1 (Sheet 4)

EFFECTIVITY: A/C WITHOUT INS

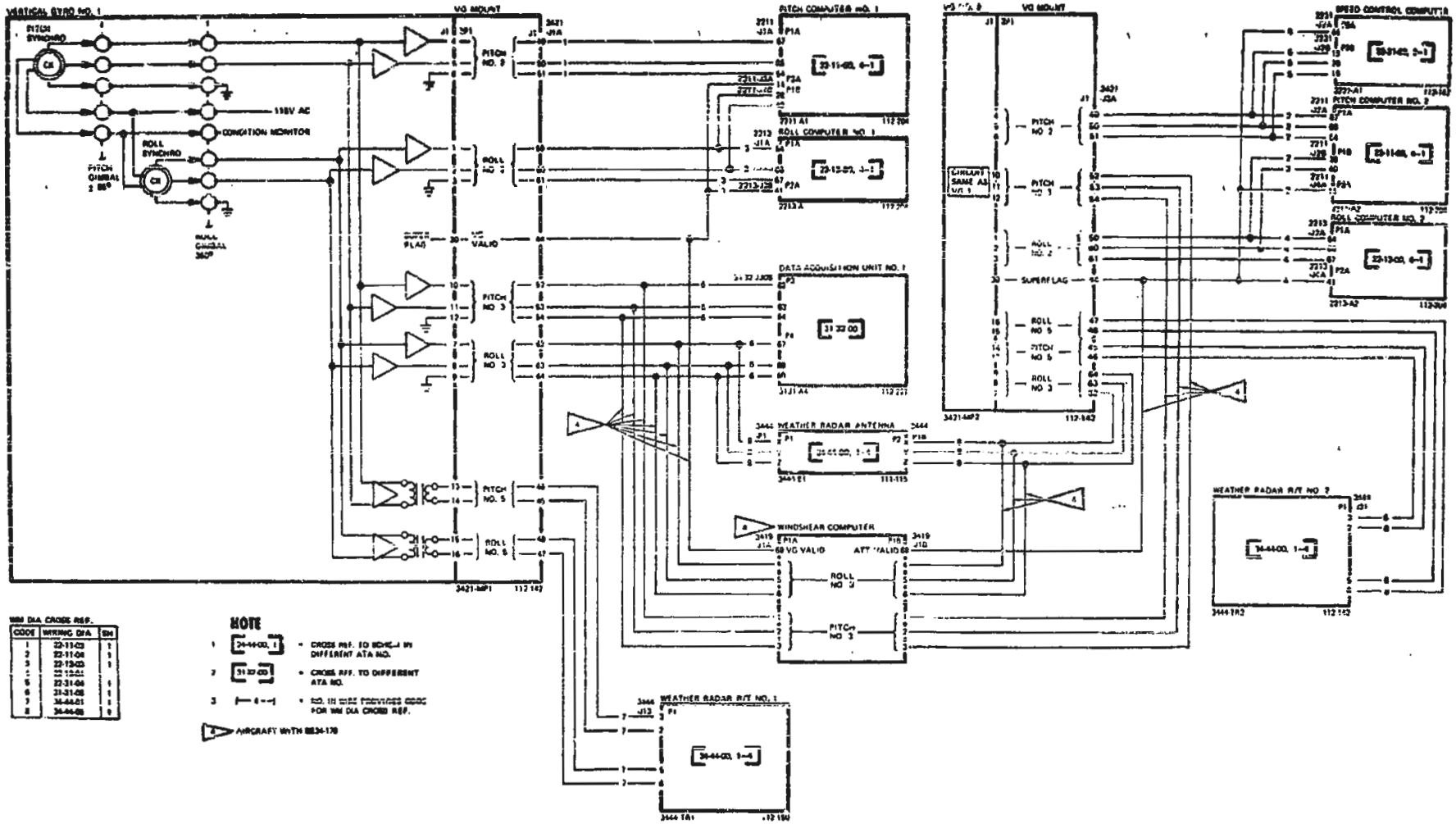
001B



R Attitude Reference System Schematic (ICM)
R SCHEM 1 (Sheet 5)

EFFECTIVITY: A/C WITHOUT INS

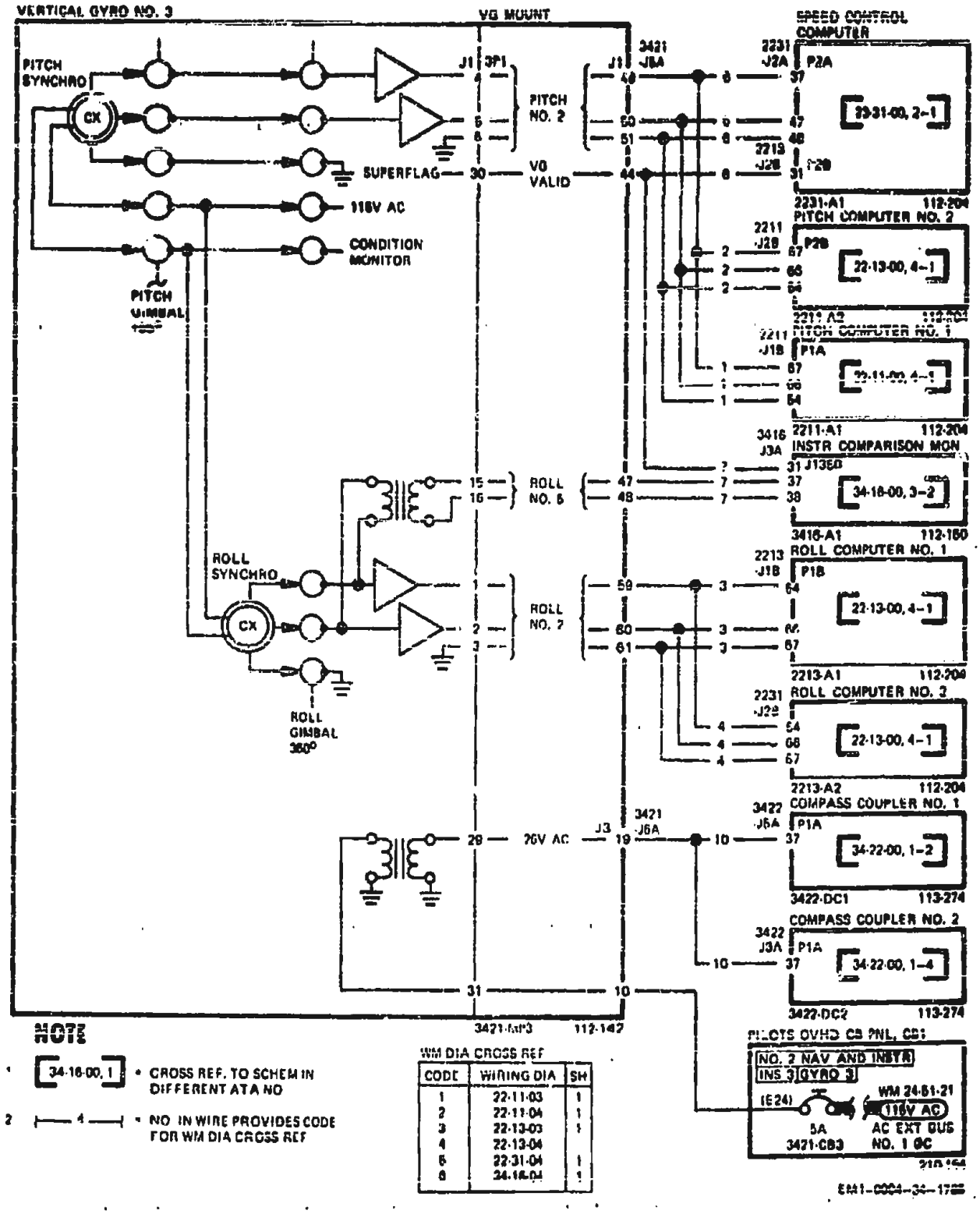
001B



R Attitude Reference System Schematic
R (System No. 1 and No. 2 Interface)
R SCHEM 2 (Sheet 1)

EFFECTIVITY: A/C WITHOUT INS

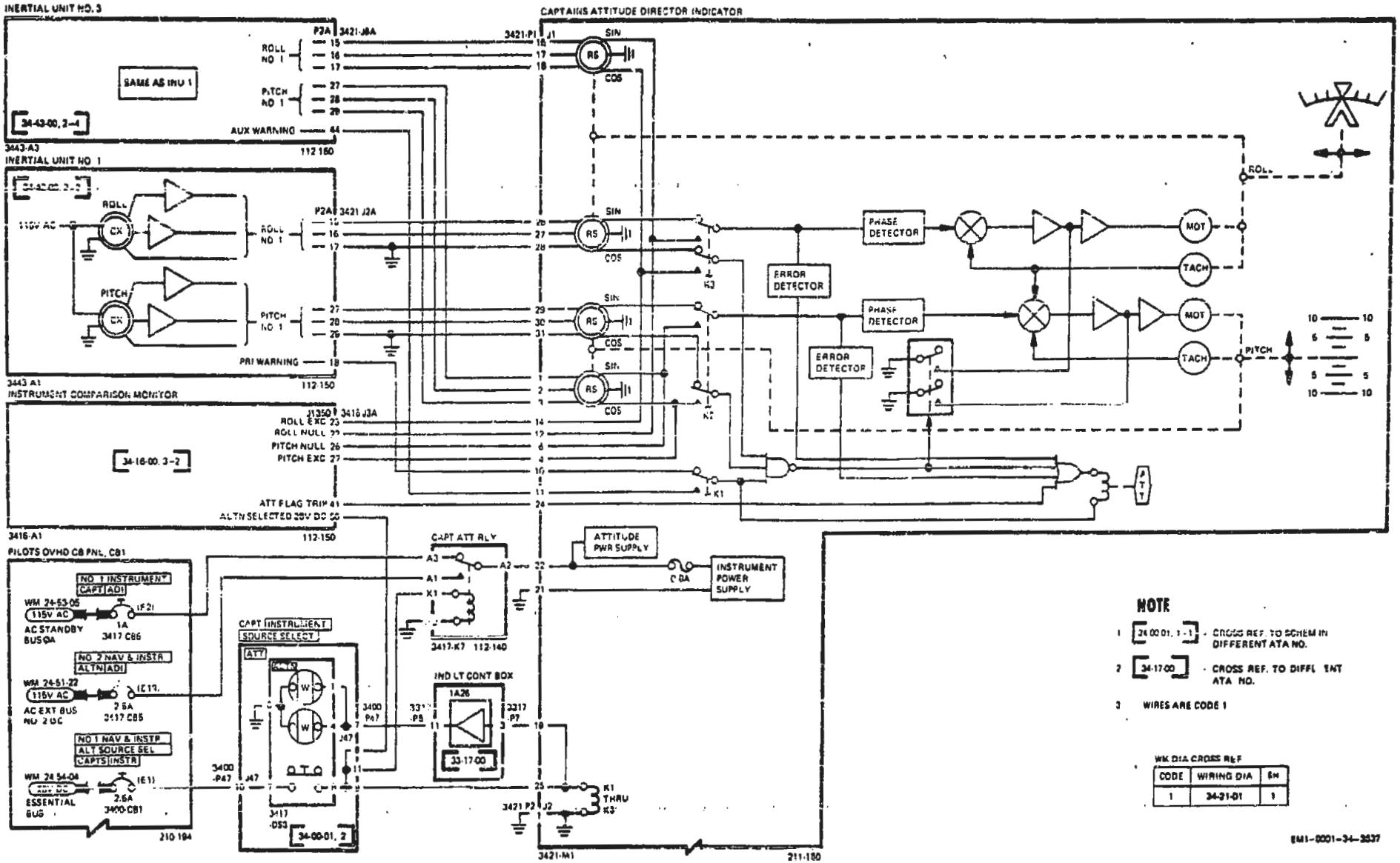
001B



R Attitude Reference System Schematic (System No. 3 Interface)
R SCHEM 2 (Sheet 2)

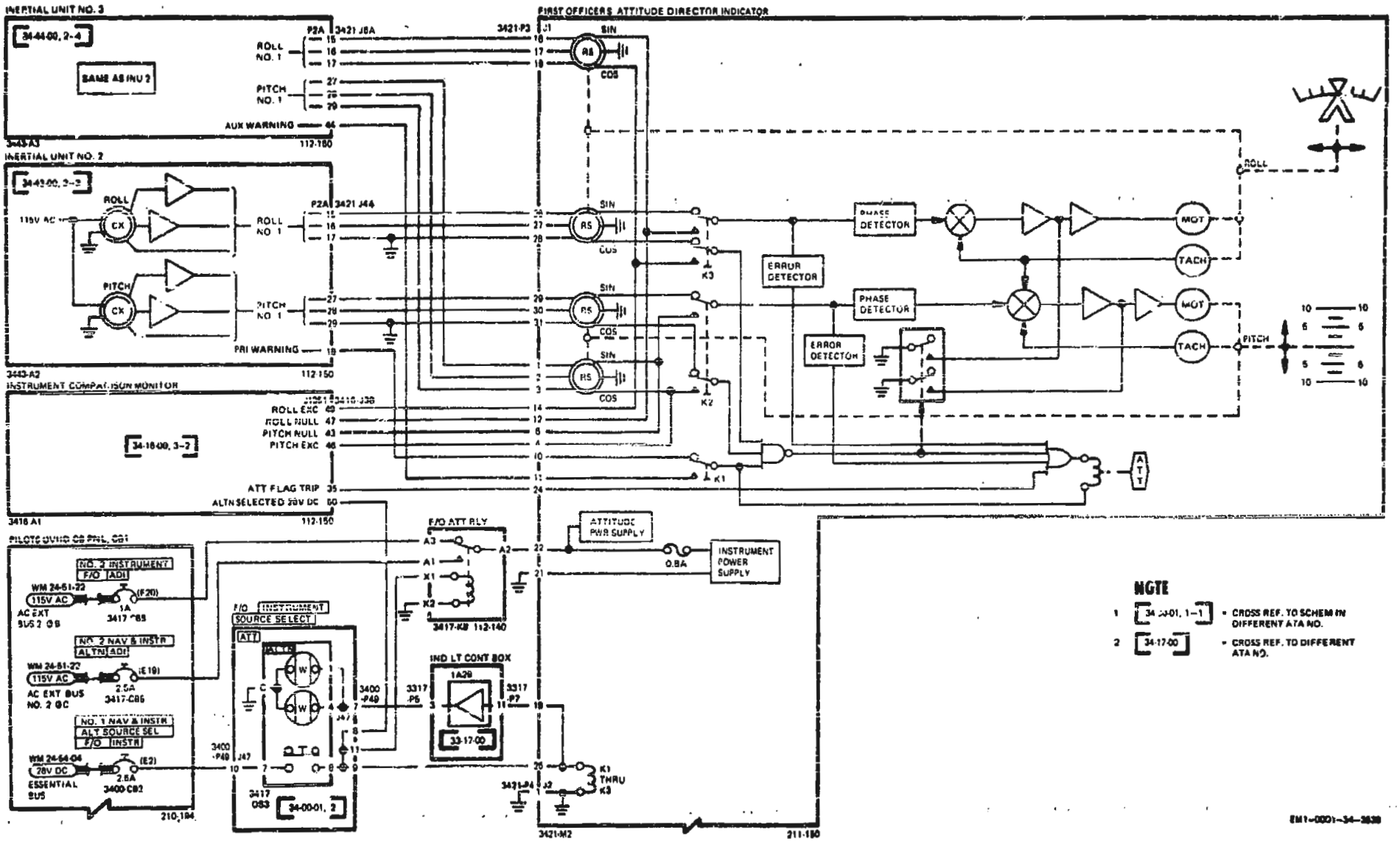
EFFECTIVITY: A/C WITHOUT INS

0019



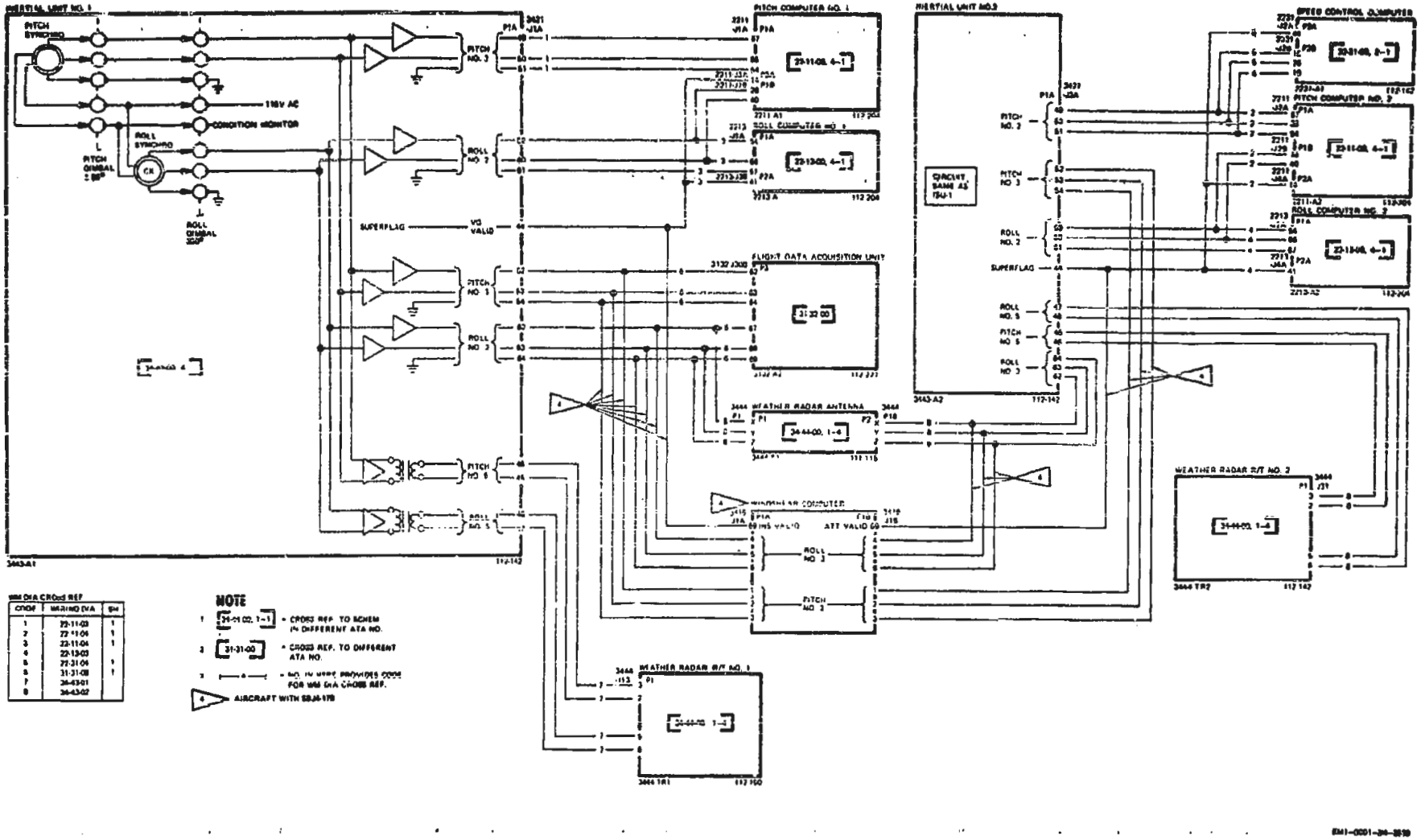
R Attitude Reference System Schematic (No. 1 System)
R SCHEM 1 (Sheet 1)

EFFECTIVITY: A/C WITH INS



Attitude Reference System Schematic (No. 3 System)
SCHEM 1 (Sheet 2)

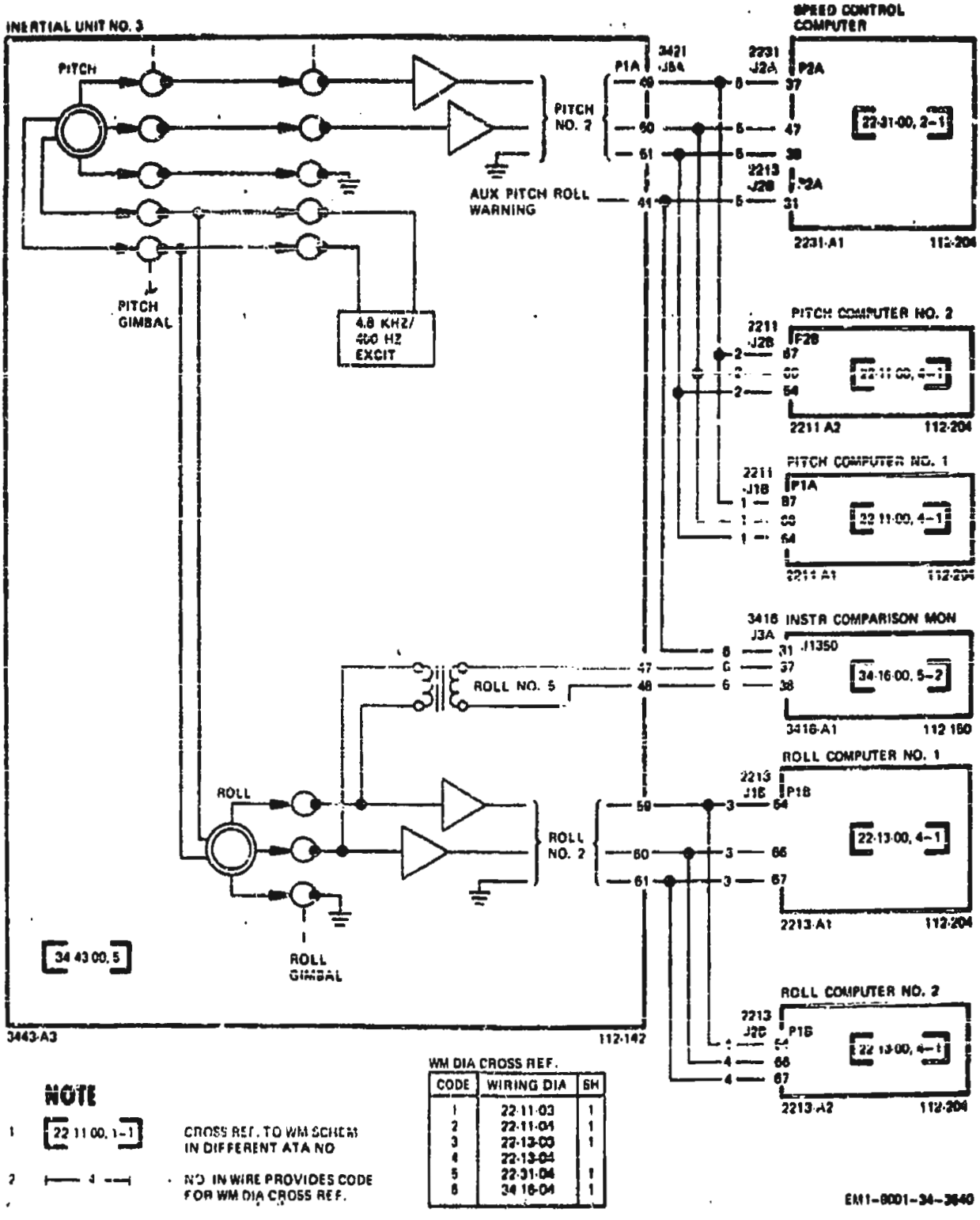
R EFFECTIVITY: A/C WITH INS
R
001B



R Attitude Reference System Schematic (No. 1 and 2 System Interface)
R SCHEM 2 (Sheet 1)

EFFECTIVITY: A/C WITH INS

001B



R Attitude Reference System Schematic (No. 3 System Interface)
R SCHEM 2 (Sheet 2)

EFFECTIVITY: A/C WITH INS

001B

R ATTITUDE REFERENCE SYSTEM - MAINTENANCE PRACTICES

R 1. General

R This test provides the capability to simulate aircraft attitude
R changes while monitoring various equipment to observe resulting
R changes in attitude displays. It can be used to verify proper
R aircraft interface wiring to calibrate the weather radar antenna
R and ADI displays, or to verify line maintenance activities such
R as replacement of ADIs, weather radar antennas, autopilot flight
R director pitch and roll computers, or to check FDAU pitch and
R roll parameters.

R 2. Equipment and Materials

R Attitude System Test Set - G/ITEL 34-21-78

R 3. Referenced Procedures

R	21-20-00	Equipment Cooling - Maintenance Practices
R	24-00-00	Electrical Power - Maintenance Practices
R R	34-00-01	Instrument Source Selector Panel - Adjustment and Test
R R	34-16-00	Central Instrument Warning System - Adjustment and Test
R	34-21-00	Attitude Reference System - Adjustment and Test
R	34-44-00	Weather Radar System - Adjustment and Test

R 4. Preparation

R NOTE: The vertical gyros and mounts will have to be removed
R from the FESC Fwd Rack (lower shelf) to allow Test Set to
R be connected.

R CAUTION: The ADIs, HSIs, AND RDDMIs (RMIs) MAY BE DAMAGED BY
R BEING OPERATED WITHOUT THE INSTRUMENT COOLING SYSTEM.
R THESE INSTRUMENTS MUST NOT BE ENERGIZED WITHOUT FIRST
R DETERMINING THAT THE COOLING SYSTEM IS COMPLETE AND
R FUNCTIONING. ENERGIZE INSTRUMENT COOLLING CIRCUIT
R BREAKER 2A21 IF NOT ALREADY ON.

R A. Initial Setup

R EFFECTIVITY: AIRCRAFT WITH VGs

R (1) On pilots overhead circuit breaker panel, CB1, open and
R tag the following circuit breakers:

R	VG/INS-2	(G6)
R	INS/VERT GYRO	(G24)
R	CAPT INSTR, ALT SOURCE SEL	(E1)
R	F/O INSTR, ALT SOURCE SEL	(E2)
R	CAPT ADI	(F2)
R	F/O ADI	(F20)
R	WEATHER RADAR IND	(D2)
R	WEATHER RADAR RT	(D3)
R	WEATHER RADAR IND	(D20)
R	WEATHER RADAR RT	(D21)
R	ALT ADI	(E19)

R (2) On FE/SO aft vertical circuit breaker panel CB3, verify
R the following circuit breakers are closed:

R	MASTER RADIO CONT	(F5)
R	ESS RADIO BUSS Aϕ	(F7)
R	NO. 2 RADIO BUS DC	(AA13)
R	NO. 2 RADIO BUS Bϕ	(AA15)

R (3) On pilots overhead circuit breaker panel CB1, open and
R tag the following circuit breakers:

R	INSTR CMPRN MON PWR	(D8)
R	INSTR CMPRN MON	(D26)

R (4) Locate Test Set G/ITEL 34-21-78 in flight station.
R Route Test Set cables through floor batch to FESC Fwd
R Rack Lower Shelf and connect in lieu of vertical gyros.

R (5) On Test Set, position each of the 9 synchros to 0° and
R SYSTEM FLAG switch S1 to position 3, FLAG switch S2 to
R ON and switch S3 to VG/LTN58.

R EFFECTIVITY: AIRCRAFT WITH VGs

001R

R NOTE: Radome does not have to be installed to perform
R the following test:

R (6) On Weather Radar Control Panel, set ANT TILT to 0° and
R place MODE switch to OFF. Set transmitter modulator
R switches to OFF and antenna scan disable switch to OFF.

R NOTE: It is not necessary to observe precise
R protractor angle of antenna. Antenna
R observation may be performed on ground. On
R pilots overhead circuit breaker panel, CB1,
R close the following circuit breakers:

R	WEATHER RADAR RT	(D3)
R	INSTR XMFR NO. 2	(D9)
R	WEATHER RADAR RT	(D21)
R	INSTR XFMR NO. 3	(D27)
R	ALT SOURCE SEL CAPT INSTR	(E1)
R	ALT SOURCE SEL F/O INSTR	(E2)
R	F/O RDDMI (RMI)	(E3)
R	ALT ADI	(E19)
R	CAPT RDDMI (RMI)	(E20)
R	VG/INS-1	(G6)
R	CMPS COUPLER	(G7)
R	INS/VERT GYRO	(G24)
R	CMPS CPLR	(G26)
R	CMPS CPLR-2	(J19)
R	CMPS CPLR-2	(K19)
R	CMPS CPLR-1	(K24)

R (7) On FE/SO overhead panel CB2, close circuit breaker IND
R LT CAPT (J2).

R (8) On FE/SO aft vertical circuit breaker panel CB3, close
R the following circuit breakers:

R	MASTER RADIO CONT	(F5)

R EFFECTIVITY: AIRCRAFT WITH VGs
R
R
001B

R	ESS RADIO BUS DC	(F6)
R	ESS RADIO BUS AC	(F7)
R	NO. 2 RADIO BUS MASTER CONT	(AA12)
R	NO. 2 RADIO BUS BC	(AA15)

R 5. Functional Tests

R A. No. 1 System Pitch and Roll Test

R (1) Verify ATT flag on Capt ADI is out of view and ADI
R indicates 0° ± 2° Pitch and 0° ± 2° Roll.

R (2) On MASTER RADIO panel, position ESSENTIAL and NO. 2
R switches to ON.

R (3) On Weather Radar Control panel, select No. 1 system and
R select TEST.

R NOTE: To prevent undesirable radiation, do not select
R any of the following Modes: NORM, CONT or MAP.

R (4) On Test Set, position SYS NO. 1 PITCH synchro to 10°
R and observe the following:

R (a) The Capt ADI must indicate a climb attitude of 10°
R ± 1°.

R (b) The Weather Radar Antenna must point down 10° ± 1°
R as indicated on the pitch gimbal protractor.

R NOTE: If necessary, increase Test Set PITCH Synchro to
R enhance Antenna response.

R (5) On pilots overhead circuit breaker panel CB1, close the
R following circuit breakers:

R	INSTR CMPRN MON PWR	(D8)
R	INSTR CMPRN MON	(D26)

R (6) Observe ATT flag is in view on Capt ADI.

R (7) On Test Set, position SYS NO. 1 PITCH synchro to 0°.

R (8) Observe that Capt ADI indicates 0° ±1° Pitch and ATT
R flag is out of view.

R R (9) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R R (10) On Test Set, position SYS NO. 1 ROLL synchro to 10° and observe the following:

R R (a) The Capt ADI must indicate a right roll of 10° ±1°.

R R (b) The Weather Radar Antenna must roll left 10° ± 1° as indicated on the roll gimbal protractor.

R R NOTE: If necessary, increase Test Set ROLL synchro to enhance antenna response.

R R (11) Close Instrument Comparison Monitor circuit breakers (D9 and D26).

R (12) Observe ATT flag is in view on Capt ADI.

R (13) On Test Set, position SYS NO. 1 ROLL synchro to 0°.

R R (14) Observe that Capt ADI indicates 0° ± 1° Roll and ATT flag is out of view.

R R (15) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R B. No. 2 System Pitch and Roll Test

R (1) On Weather Radar Control panel, select No. 2 system.

R R (2) On Test Set, position SYS NO. 2 PITCH synchro to 10° and observe the following:

R R (a) The F/O ADI must indicate a climb attitude of 10° ± 1°.

R R (b) The Weather Radar Antenna must point down 10° ± 1° as indicated on the pitch gimbal protractor.

R R NOTE: If necessary, increase Test Set PITCH synchro to enhance antenna response.

R R (3) Close Instrument Comparison Monitor circuit breakers (D8 a D26).

R (4) Observe ATT flag is in view on F/O ADI.

R (5) On Test Set, position SYS NO. 2 PITCH synchro to 0°.

R (6) Observe that F/O ADI indicates 0° ± 1° Pitch and ATT flag is out of view.

R (7) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (8) On Test Set, position SYS NO. 2 ROLL synchro to 10° and observe the following:

R (a) The F/O ADI must indicate a right roll of 10° ± 1°.

R (b) Weather Radar Antenna must roll left 10° ± 1° as indicated on the roll gimbal protractor.

R NOTE: If necessary, increase Test Set ROLL synchro to enhance antenna response.

R (9) Close Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (10) Observe ATT flag is in view on F/O ADI.

R (11) On Test Set, position SYS NO. 2 Roll synchro to 0°.

R (12) Observe that F/O ADI indicates 0° ± 1° Roll and ATT flag is out of view.

R (13) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (14) Select OFF on Weather Radar Control Panel, set transmitter modulator switches ON, set antenna disable switch to OFF.

R C. No. 3 System Pitch and Roll Test

R (1) On Test Set, position SYS NO. 3 PITCH synchro to 10°.

R (2) Close Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (3) The VERTICAL GYRO 3 light on CAWP will come on.

R (4) On Capt Instrument Source Select Panel, depress ATT to turn on ALTN legend and observe:

R (a) The Capt ADI indicates a 10° ± 1° climb and ATT flag is out of view.

R (b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

R (5) On Capt Instrument Source Select Panel, depress ATT to
R turn off ALTN legend.

R (6) On F/O Instrument Source Select Panel, depress ATT to
R turn on ALTN legend and observe:

R (a) The F/O ADI indicates a 10° ± 1° climb and ATT
R flag is out of view.

R (b) The ATTITUDE annunciators on both INSTR COMPARATOR
R Warning Displays must be showing.

R (7) On Test Set, slowly rotate SYS NO. 3 PITCH synchro
R toward zero degrees and observe that between 6° and 2°
R on F/O ADI, the ATTITUDE annunciator on both INSTR
R COMPARATOR Warning Displays is out of view (blank
R display).

R (8) On Test Set, position SYS NO. 3 PITCH synchro to 0°.

R (9) On F/O Instrument Source Select Panel, depress ATT to
R turn out ALTN legend.

R (10) Open Instrument Comparison Monitor circuit breakers
R (1D8 and 1D26).

R (11) On Test Set, position SYS NO. 3 ROLL synchro to 10° ±
R 1°.

R (12) Close Instrument Comparison Monitor circuit breakers
R (1D8 and 1D26).

R (13) The VERTICAL GYRO 3 light on the CAWP must come on.

R (14) On Capt Instrument Source Select Panel, depress ATT to
R turn on ALTN legend and observe:

R (a) The Capt ADI indicates a right roll of 10° ± 1°
R and ATT flag is out of view.

R (b) The annunciators on both INSTR COMPARATOR Warning
R Displays must be showing.

R (15) On Capt Instrument Source Select Panel, depress ATT to
R turn off ALTN legend.

R (16) On F/O Instrument Source Select Panel, depress ATT to
R turn on ALTN legend and observe:

R (a) The F/O ADI must indicate a right roll of 10° ± 1°
R and ATT flag must be out of view.

(b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

(17) On Test Set, slowly rotate SYS NO. 3 ROLL synchro toward zero degrees and observe that between 6° and 2° on F/O ADI, the ATTITUDE annunciator on both INSTR COMPARATOR Warning Displays is out of view (blank display).

(18) On Test Set, position SYS NO. 3 ROLL synchro to 0°.

(19) On F/O Instrument Source Select Panel, depress ATT to turn out ALTN legend.

(20) Open INSTR CMPRN MON (1D26) circuit breaker.

(21) Observe that all warning displays on both INSTR COMPARATOR displays go to their monitor position (amber cross hatched).

D. MAG Mode Check

NOTE: This test to be performed prior to compass systems calibration.

(1) Verify maintenance monitors on both Compass Couplers are black.

(2) Select DG mode on both Compass Controllers. Verify DG legend is on in Compass Controller switches.

(3) Select MAG mode on both Compass Controllers.

(4) The HDG flags on both HSIs and both RDDMIs must be out of view.

(5) The annunciators, on both compass Controllers, must indicate a null (needle centered).

(6) All four (4) heading instruments must indicate approximate aircraft heading ± 20°. Note heading indication on each instrument.

E. Set Heading Checks

(1) Select DG on both Compass Controllers.

(2) On each Compass Controller, verify operation of set heading control as follows:

R (a) Select and hold first CW position and verify corresponding HSI heading increases at a slow rate and HSI HDG flag is in view.

R (b) Select and hold second CW position and verify corresponding HSI heading increases at a fast rate and the HSI HDG flag is in view.

R (c) Select and hold in turn, the first and second CCW positions and verify corresponding HSI heading decreases at a slow and a fast rate with HSI HDG flag in view.

R (d) Release set heading control and check corresponding HSI heading is stationary and HSI HDG flag is out of view.

R (3) On each Compass Controller, use set heading control to set each HSI to a heading approximately 60° greater than noted in Step 5D(6).

R (4) Select MAG mode on both Compass Controllers.

R (a) Check that annunciators on both Compass Controllers deflect right.

R (b) Observe that within approximately 30 seconds both HSIs return to within 3° of reading noted in Step 5D(6) and flags are out of view.

R F. DG Heading Checks (Capt Controller)

R (1) On Capt Compass Controller, select DG mode.

R (2) On Test Set, position SYS NO. 1 HDG synchro to 90°.

R (3) Observe CAPT HSI and F/O RDDMI. Both instruments must increase heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (4) On Test Set, position SYS NO. 1 HDG synchro to 270°.

R (5) Both instruments must decrease heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (6) On Test Set, position SYS NO. 1 HDG synchro to 0°.

R G. DG Heading Checks (F/O Controller)

R (1) On F/O Compass Controller, select DG mode.

R (2) On Test Set, position SYS NO. 2 HDG synchro to 90°.

R (3) Observe F/O HSI and Capt RDDMI. Both instruments must
R increase heading indication from that noted in Step
R 5D(6) by 90° ± 5°.

R (4) On Test Set, position SYS NO. 1 HDG synchro to 270°.

R (5) Both instruments must decrease heading indication from
R that noted in Step 5D(6) by 90° ± 5°.

R (6) On Test Set, position SYS NO. 1 HDG synchro to 0°.

R (7) Open same circuit breakers as in Step 4(1).

R (8) Observe HDG flags on both HSIs and both RDDMIs are in
R view.

R (9) Close circuit breakers opened in Step 5G(7).

R H. Heading Switching and Comparison Monitor Checks

R (1) Close INSTR CMPRN MON (1D26) circuit breaker.

R (2) On Capt Compass Controller, use slew control to set
R Capt HSI heading same as F/O heading within 2 degrees
R and note heading.

R (3) On test set, position SYS NO. 1 HDG Synchro to 10°, SYS
R NO. 2 HDG Synchro to 0°, and SYS NO. 3 HDG Synchro to
R 345°.

R (a) Verify HEADING annunciators are displayed on both
R INSTR COMPARATOR indicators.

R (4) On Capt Instrument Source Select Panel, depress HDG to
R turn on ALTN legend.

R (5) Verify Capt HSI indicates same heading as F/O HSI
R within 2°.

R (6) On F/O Instrument Source Select Panel, depress HDG
R once. The ALTN legend must not come on and the F/O HSI
R must not change heading indication. Depress HDG
R switchlight a second time to return to original state.

R (7) On Capt Instrument Source Select Panel, depress HDG
R switchlight to turn off ALTN legend.

R (8) On F/O Instrument Source Select Panel, depress HDG
R switchlight to turn on ALTN legend.

R (9) Verify F/O HSI indicates same as Capt HSI within 2°.

R (10) On Capt Instrument Source Select Panel, depress HDG
R switchlight once. The ALTN legend must not come on and
R the Capt HSI must not change heading indication.
R Depress HDG switchlight a second time to return to
R original state.

R (11) F/O Instrument Source Select Panel, depress HDG to turn
R out ALTN legend.

R (12) On test set, position all HDG Synchros to 0°.

R (a) Verify HEADING annunciators on both INSTR
R COMPARATOR indicators are blank.

R J. Standby Horizon Check

R (1) Close STBY-HRZN IND (1F6) circuit breaker.

R (2) After approximately one (1) minute, pull caging knob
R until horizon drum comes to a standstill then release
R knob abruptly without slamming.

R (3) Approximately two (2) minutes after caging, observe
R that gyro is erect within ± 1° in both pitch and roll
R axes, and warning flag has retracted out of view.

R (4) Open and tag STBY-HRZN IND (1F6) circuit breaker.

R K. Test Conclusion

R (1) On test set, set POWER switch to OFF.

R (2) Open and tag all circuit breakers referenced in Steps
R 4A(3), 4A(4) and 4F(1) if not in use.

R (3) Disconnect intercept harness from test set and gyros.
R Replace normal gyro cabling and verify maintenance
R annunciators on all Vertical Gyros and Compass Couplers
R are black.

R (4) Select OFF on Weather Radar Control Panel. On Weather
R Radar R/T units set transmitter modulator switches to
R ON.

R (5) Turn antenna drive switches to ON.

R (6) Turn off aircraft electrical power (Ref. 24-00-00).

R ATTITUDE REFERENCE SYSTEM - MAINTENANCE PRACTICES

R 1. General

R This test provides the capability to simulate aircraft attitude changes while monitoring various equipment to observe resulting changes in attitude displays. It can be used to verify proper aircraft interface wiring to calibrate the weather radar antenna and ADI displays, or to verify line maintenance activities such as replacement of ADIs, weather radar antennas, autopilot flight director pitch and roll computers or to check FDAU pitch and roll parameters.

R 2. Equipment and Materials

R Attitude/Heading System Test Set - G/TEL, 34-21-78

R 3. Referenced Procedures

R	21-20-00	Equipment Cooling - Maintenance Practices
R	24-00-00	Electrical Power - Maintenance Practices
R R	34-00-01	Instrument Source Selector Panel - Adjustment and Test
R R	34-16-00	Central Instrument Warning System - Adjustment and Test
R	34-21-00	Attitude Reference System - Adjustment and Test
R	34-43-00	Inertial Navigation System - Adjustment and Test
R	34-44-00	Weather Radar System - Adjustment and Test

R 4. Preparation

R NOTE: The Navigation Units will have to be removed from the R FESC Fwd Rack (lower shelf) to allow Test Set to be R connected.

R CAUTION: THE ADIs, HSIs, AND RDDMIs (RMIs) MAY BE DAMAGED BY R BEING OPERATED WITHOUT THE INSTRUMENT COOLING SYSTEM. R THESE INSTRUMENTS MUST NOT BE ENERGIZED WITHOUT FIRST R DETERMINING THAT THE COOLING SYSTEM IS COMPLETE AND R FUNCTIONING. ENERGIZE INSTRUMENT COOLING CIRCUIT R BREAKER 2A21 IF NOT ALREADY ON.

R (1) On pilots overhead circuit breaker panel, CB1, open and
R tag the following circuit breakers:

R VG/INS-1 (G6)

R INS PWR (E6)

R INS HTR (E7)

R VG/INS-2 (G24)

R INS HTR (G25)

R VG/INS-3 (E24)

R INS-3 HTR (E25)

R (2) Locate Test Set G/ITEL 34-21-78 in flight station.
R Route Test Set cables through floor hatch to FESC Fwd
R Rack Lower Shelf and connect in lieu of Inertial units.

R (3) On Test Set, position each of the 9 synchros to 0° and
R SYSTEM FLAG switch S1 to position 3, FLAG switch S2 to
R ON and switch S3 to DELCO.

R (4) On Weather Radar Control Panel, set ANT TILT to 0° and
R place MODE switch to Off. Open radome and set antenna
R scan disable switch to OFF.

R NOTE: Radome does not have to be installed to perform
R the following test.

R It is not necessary to observe precise protactor
R angle of antenna. Antenna observation may be
R performed on ground.

R (5) On pilots overhead circuit breaker panel, CB1, engage
R the following circuit breakers:

R WEATHER RADAR RT (D3)

R INSTR XMFR NO. 2 (D9)

R WEATHER RADAR RT (D21)

R INSTR XFMR NO. 3 (D27)

R ALT SOURCE SEL CAPT INSTR (E1)

R ALT SOURCE SEL F/O INSTR (E2)

R F/O RDDMI (E3)

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
R
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R	ALT ADI	(E19)
R	CAPT RDDMI	(E20)
R	VG/INS-3	(E24)
R	CAPT ADI	(F2)
R	CAPT HSI	(F3)
R	INSTR XFMR NO. 1	(F5)
R	F/O ADI	(F20)
R	F/O HSI	(F21)
R	VG/INS-1	(G6)
R	CMPS COUPLER	(G7)
R	VG/INS-2	(G24)
R	INS HTR	(G25)
R	CMPS CPLR	(G26)
R	CMPS CPLR-2	(J19)
R	CMPS CPLR-1	(K19)
R	CMPS CPLR-1	(K24)

R (6) On Flight Engineer/SO overhead panel, CB2, engage
R circuit breaker IND LT CAPT (J2)

R (7) On Flight Engineer/SO aft vertical circuit breaker
R panel, CB3, engage the following circuit breakers:

R	MASTER RADIO CONT	(F5)
R	ESS RADIO BUS DC	(F6)
R	ESS RADIO BUS Aϕ	(F7)
R	NO. 2 RADIO BUS MASTER CONT	(AA12)
R	NO. 2 RADIO BUS Bϕ	(AA15)

R (8) On center console, select RADIO on RAD/NAV
R switchlights.

R 5. Functional Tests

R A. No. 1 System Pitch and Roll Test

R (1) Verify ATT flag on Capt ADI is out of view and ADI
R indicates 0° ± 2° Roll.

R (2) On MASTER RADIO panel, position ESSENTIAL and NO. 2
R switches to ON.

R (3) On Weather Radar Control panel, select No. 1 system and
R select TEST.

R NOTE: To prevent undesirable radiation, do not select
R any of the following Modes: NORM, CONT or MAP

R (4) On Test Set, position SYS No. 1 PITCH synchro to 10°
R and observe the following:

R (a) The Capt ADI must indicate a climb attitude of 10°
R ± 1°.

R (b) The Weather Radar Antenna must point down 10° ± 1°
R as indicated on the pitch gimbal protractor.

R NOTE: If necessary, increase Test Set PITCH
R Synchro to enhance Antenna response.

R (5) On pilots overhead circuit breaker panel, CB1, engage
R the following circuit breakers:

R INSTR CMPRN MON PWR (D8)

R INSTR CMPRN MON (D26)

R (6) Observe ATT flag is in view on Capt ADI.

R (7) On Test Set, position SYS No. 1 PITCH synchro to 0°.
R (8) Observe that Capt ADI indicates 0° ± 1° Pitch and
R ATT flag is out of view.

R (9) Open Instrument Comparison Monitor circuit breakers
R (1D8 and 1D26).

R (10) On Test Set, position SYS No. 1 ROLL synchro to 10° and
R observe the following:

R (a) The Capt ADI must indicate a right roll of 10° ±
R 1°.

R (b) The Weather Radar Antenna must roll left 10° ± 1°
R as indicated on the roll gimbal protractor.

R R NOTE: If necessary, increase Test Set ROLL synchro to enhance antenna response.

R (11) Close Instrument Comparison Monitor circuit breakers R (1D8 and 1D26).

R (12) Observe that ATT flag is in view on Capt ADI.

R (13) On Test Set, position SYS No. 1 ROLL synchro to 0°.

R (14) Observe that Capt ADI indicates 0° ± 1° Roll and ATT R flag is out of view.

R (15) Open Instrument Comparison Monitor circuit breakers R (1D8 and 1D26).

R B. No. 2 System Pitch and Roll Test:

R (1) On Weather Radar Control panel, select No. 2 system.

R (2) On Test Set, position SYS No. 2 PITCH synchro to 10° R and observe the following:

R (a) The F/O ADI must indicate a climb attitude of 10° R ± 1°.

R (b) The Weather Radar Antenna must point down 10° ± 1° R as indicated on the pitch gimbal protractor.

R NOTE: If necessary, increase Test Set PITCH R synchro to enhance antenna response.

R (3) Close Instrument Comparison Monitor circuit breakers R (1D8 and 1D26).

R (4) Observe that ATT flag is in view on F/O ADI.

R (5) On Test Set, position SYS No. 2 PITCH synchro to 0°.

R (6) Observe that F/O ADI indicates 0° ± 1° Pitch and ATT R flag is out of view.

R (7) Open Instrument Comparison Monitor circuit breakers R (1D8 and 1D26).

R (8) On Test Set, position SYS No. 2 ROLL synchro to 10° and R observe the following:

R (a) The F/O ADI must indicate a right roll of 10° ± R 1°.

R (b) The Weather Radar Antenna must roll left 10° ± 1° as indicated on the roll gimbal protractor.

NOTE: If necessary, increase Test Set ROLL synchro to enhance antenna response.

(9) Close Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

(10) Observe that ATT flag is in view on F/O ADI.

(11) On Test Set, position SYS No. 2 Roll synchro to 0°.

(12) Observe that F/O ADI indicates 0° ± 1° Roll and ATT flag is out of view.

(13) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

(14) Select OFF on Weather Radar Control Panel, set transmitter modulator switches and antenna scan disable switch to ON.

C. No. 3 System Pitch and Roll Test

(1) On Test Set, position SYS No. 3 PITCH synchro to 10°.

(2) Close Instrument Comparison Monitor circuit breakers (1D3 and 1D26).

(3) The VERTICAL GYRO 3 light on CAWP must come on.

(4) On Capt Instrument Source Select Panel, depress ATT to turn on ALTN legend and observe:

(a) The Capt ADI must indicate a 10° ± 1° climb and ATT flag must be out of view.

(b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

(5) On Capt Instrument Source Select Panel, depress ATT to turn off ALTN legend.

(6) On F/O Instrument Source Select Panel, depress ATT to turn on ALTN legend and observe:

(a) The F/O ADI must indicate a 10° ± 1° climb and ATT flag must be out of view.

(b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

R (7) On Test Set, slowly rotate SYS No. 3 PITCH synchro toward zero degrees and observe that between 6° and 2° on F/O ADI, the ATTITUDE annunciator on both INSTR COMPARATOR Warning Displays is out of view (blank display).

R (8) On Test Set, position SYS No. 3 PITCH synchro to 0°.

R (9) On F/O Instrument Source Select Panel, depress ATT to turn out ALTN legend.

R (10) Open Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (11) On Test Set, position SYS No. 3 ROLL synchro to 10° ± 1°.

R (12) Close Instrument Comparison Monitor circuit breakers (1D8 and 1D26).

R (13) The VERTICAL GYRO 3 light on the CAWP must come on.

R (14) On Capt Instrument Source Select Panel, depress ATT to turn on ALTN legend and observe:

R (a) The Capt ADI indicates a right roll of 10° ± 1° and ATT flag is out of view.

R (b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

R (15) On Capt Instrument Source Select Panel, depress ATT to turn off ALTN legend.

R (16) On Instrument Source Select Panel, depress ATT to turn on ALTN legend and observe:

R (a) The F/O ADI indicates a right roll of 10° ± 1° and ATT flag is out of view.

R (b) The ATTITUDE annunciators on both INSTR COMPARATOR Warning Displays must be showing.

R (17) On Test Set, slowly rotate SYS No. 3 ROLL synchro toward zero degrees and observe that between 6° and 2° on F/O ADI, the ATTITUDE annunciator on both INSTR COMPARATOR Warning Displays is out of view (blank display).

R (18) On Test Set, position SYS No. 3 ROLL synchro to 0°.

R (19) On F/O Instrument Source Select Panel, depress ATT to
R turn out ALTN legend.

R (20) Open INSTR CMPRN MON (1D26) circuit breaker.

R (21) Observe that all warning displays on both INSTR
R COMPARATOR displays go to their monitor position (amber
R cross hatched).

R D. MAG Mode Check

R NOTE: This test to be performed prior to compass systems
R calibration.

R (1) Verify maintenance monitors on both Compass Couplers
R are black.

R (2) Select DG mode on both Compass Controllers. Verify DG
R legend is on in Compass Controller switches.

R (3) Select MAG mode on both Compass Controllers.

R (4) The HDG flags on both HSIs and both RDDMIs must be out
R of view.

R (5) The annunciators, on both Compass Controllers, must
R indicate a null (needle centered).

R (6) All four (4) heading instruments must indicate
R approximate aircraft heading ± 20°. Note heading
R indication on each instrument.

R E. Set Heading Checks

R (1) Select DG on both Compass Controllers.

R (2) On each Compass Controller, verify operation of set
R heading control as follows:

R (a) Select and hold first CW position and verify
R corresponding HSI heading increases at a slow rate
R and HSI HDG flag is in view.

R (b) Select and hold second CW position and verify
R corresponding HSI heading increases at a fast rate
R and the HSI HDG flag is in view.

R (c) Select and hold in turn, the first and second CCW
R positions and verify corresponding HSI heading
R decreases at a slow and a fast rate with HSI HDG
R flag in view.

R (d) Release set heading control and check corresponding HSI heading is stationary and HSI HDG flag is out of view.

R (3) On each Compass Controller, use set heading control to set each HSI to a heading approximately 60° greater than that noted in Step 5D(6).

R (4) Select MAG mode on both Compass Controllers.

R (a) Check that annunciators on both Compass Controllers deflect right.

R (b) Observe that within approximately 30 seconds both HSIs return to within 3° of reading noted in Step 5D(6) and flags are out of view.

R F. Platform Heading Checks (Capt Controller)

R (1) On Capt Compass Controller, select DG mode.

R (2) On Test Set, position SYS No. 1 HDG synchro to 90°.

R (3) Observe Capt HSI and F/O RDDMI. Both instruments must increase heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (4) On Test Set, position SYS No. 2 HDG synchro to 270°.

R (5) Both instruments must decrease heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (6) On Test Set, position SYS No. 1 HDG synchro to 0°.

R G. Platform Heading Checks (F/O Controller)

R (1) On F/O Compass Controller, select DG mode.

R (2) On Test Set, position SYS No. 2 HDG synchro to 90°.

R (3) Observe F/O HSI and Capt RDDMI. Both instruments must increase heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (4) On Test Set, position SYS No. 2 HDG synchro to 270°.

R (5) Both instruments must decrease heading indication from that noted in Step 5D(6) by 90° ± 5°.

R (6) On Test Set, position SYS No. 2 HDG synchro to 0°.

R (7) Open and tag same circuit breakers as in Step 4(1).

R (8) Observe HDG flags on both HSIs and both RDDMIs are in
R view.

R (9) Close circuit breakers opened in Step 5G(7).

R H. Heading Switching and Comparison Monitor Checks

R (1) Engage INSTR CMPRN MON (1D26) circuit breaker.

R (2) On Capt Compass Controller, use slew control to set
R Capt HSI heading same as F/O heading within 2 degrees
R and note heading.

R (3) On test set, position SYS No. 1 HDG Synchro to 10°, SYS
R No. 2 HDG Synchro to 0°, and SYS No. 3 HDG Synchro to
R 345°.

R (a) Verify HEADING annunciators are displayed on both
R INSTR COMPARATOR indicators.

R (4) On Capt Instrument Source Select Panel, depress HDG to
R turn on ALTN legend.

R (5) Verify Capt HSI indicates same heading as F/Os HSI
R within 2°.

R (6) On F/O Instrument Source Select Panel, depress HDG
R once. The ALTN legend must not come on and F/O HSI
R must not change heading indication. Depress HDG
R switchlight a second time to return to original state.

R (7) On Capt Instrument Source Select Panel, depress HDG
R switchlight to turn off ALTN legend.

R (8) On F/O Instrument Source Select Panel, depress HDG
R switchlight to turn on ALTN legend.

R (9) Verify F/O HSI indicates same as Capt HSI within 2°.

R (10) On Capt Instrument Source Select Panel, depress HDG
R switchlight once. The ALTN legend must not come on and
R Capt HSI must not change heading indication. Depress
R HDG switchlight a second time to return to original
R state. On F/Os Instrument Source Select Panel,
R depress HDG to turn out ALTN legend. On test set,
R position all HDG synchros to 0°. Verify HEADING
R annunciators on both INSTR COMPARATOR indicators are
R now blank.

R I. Standby Horizon Check

R (1) Engage STBY-HRZN IND (1F6) circuit breaker.

(2) After approximately one (1) minute, pull caging knob until horizon drum comes to a standstill then release knob abruptly without slamming.

(3) Approximately two (2) minutes after caging, observe that gyro is erect within ± 1° in both pitch and roll axes, and warning flag has retracted out of view.

(4) Open and tag STBY-HRZN IND (1F6) circuit breaker.

J. Test Conclusion

R (1) Open and tag circuit breakers referenced in Steps 4(1), R 4(5) and 4(6).

R (2) Verify maintenance monitors on both Compass Couplers R are black.

R (3) Disconnect Test Set from FESC Fwd Rack.

R (4) Verify maintenance annunciators on Inertial Units are R black.

R (5) Select OFF on Weather Radar Control Panel. On Weather R Radar R/T units set the transmitter modulator switches R and antenna drive switches to ON.

R (6) Turn off aircraft electrical power (Ref. 24-00-00).

ATTITUDE REFERENCE SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

Timer

2. Referenced Procedures

8-10-00 Leveling - Description and Operation

24-00-00 Electrical Power - Maintenance Practices

NOTE: Following procedures required only if functional test is to be performed.

34-21-04 Vertical Gyro (VG) - Removal and Installation

34-44-00 Weather Radar System - Adjustment and Test

NOTE: Three inertial units (IU) are installed on aircraft with INS, refer to Inertial Navigation System (Ref. 34-43-00).

3. Adjustment/Test

C A. Preparation

NOTE: Satisfactory performance of the operational test (Paragraph 3B) ascertains that VG and attitude functions of ADI are operable. If more detailed testing is to be performed, procedures in the functional tests (Paragraph 3C and 3D) should be performed.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

VG/INS-1 (G6)

INS/VERT GYRO (G24)

INS-3/GYRO-3 (E24)

R (2) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

R ALT SOURCE SEL - CAPTS INSTR (E1)

R ALT SOURCE SEL - F/O INSTR (E2)

ALTN ADI (E19)

CAPT ADI (F2)

F/O ADI (F20)

NOTE: The following circuit breakers required only if functional test is to be performed.

NO. 1 NAVIGATION WEATHER RADAR-IND (D2) and RT (D3)

NO. 2 NAVIGATION WEATHER RADAR-IND (D20) and RT (D21)

R (3) Turn on electrical power (Ref. 24-00-00).

R (4) On FE/SO-ECS MONITOR panel, verify AVIONIC AIR-FWD and MID LO FLO lights are out.

B. Vertical Gyro No. 1, 2 and 3 Operational Test

NOTE: Vertical gyro No. 1 tests are shown. VG-2 differences are shown in brackets.

CAUTION: IF ELECTRICAL POWER HAS BEEN OFF VERTICAL GYRO FOR 90 SECONDS OR MORE, POWER SHOULD REMAIN OFF FOR AT LEAST 10 MINUTES TO ASSURE PROPER ERECTION OF GYRO UPON REAPPLICATION OF POWER.

(1) On pilots overhead circuit breaker panel CB1, close circuit breaker VG/INS 1 (G6) [INS/VERT GYRO (G24)] and simultaneously start timer.

R CAUTION: THE 5 MINUTE TIME APPLIES TO A TEMPERATURE OF 68°F
R (20°C). IN EXTREME COLD CONDITIONS, GYRO SPIN UP
R TIME TO ATT FLAG OUT OF VIEW CAN BE AS LONG AS 15
R MINUTES.

(2) After 5 minutes, verify ATT flag on Captains [F/O] attitude director indicator (ADI) located on Captains [F/O] instrument panel, zone 211 [212], is out of view, and ADI indicates 0 (±2) degrees pitch and roll. If ADI attitude display is displaced greater than 2 degrees from level, check aircraft attitude for agreement with ADI attitude display (Ref. 8-10-00).

(3) On INSTRUMENT SOURCE SELECT panel on both Captains and F/O instrument panels depress ALTN ATT switchlight, verify ALTN legend comes on.

(4) On pilots overhead circuit breaker panel CB1, close circuit breaker INS-3/GYRO 3 (E24), repeat Step B(2).

C. Vertical Gyro No. 1 and 2 Functional Test

(1) Perform Paragraphs 3A and 3B.

(2) On weather radar control panel in flight station center console, zone 210, set SYSTEM 1-2 switch to 1 [2], and depress STBY switchlight (Ref. 34-44-00). Verify STBY legend comes on.

WARNING: VERIFY THAT A 135-DEGREE SECTOR FORWARD OF THE NOSE RADOME IS CLEAR OF PERSONNEL AND ANY LARGE METALLIC OBJECTS FOR A DISTANCE OF 46 FEET. VERIFY THAT REFUELING OPERATIONS ARE NOT IN PROGRESS WITHIN 46 FEET OF AIRCRAFT.

(3) On weather radar control panel, depress NORM switchlight. Verify NORM legend comes on.

(4) On Captains and First Officers weather radar indicators located on Captains and First Officers instrument panels, zones 211 and 212, verify that available targets are displayed. (It may be necessary to rotate tilt control for target acquisition.)

(5) In forward electronic service center (FESC) forward rack, zone 112, release captive screws securing vertical gyro No. 1 (VG-1, [No. 2 (VG-2)] to mount (Ref. 34-21-04).

NOTE: Two men are required to perform Steps 3C(6) through 3C(19).

(6) In FESC, carefully lift VG-1 [VG-2] out of mount and put in pitch-up then pitch-down attitude (electrical connector down then up).

(7) Verify Captains [F/O] ADI indicates pitch-up then pitch-down attitude.

(8) On Captains and First Officers weather radar indicators, verify pitch-up then pitch-down attitudes are displayed.

NOTE: If difficulty is encountered in determining pitch-up attitude on weather radar indicator display, proceed as follows: Set VG-1 [VG-2] back in mount, rotate antenna tilt control downward (CCW) until a prominent target is displayed, rotate antenna tilt control slowly CW

until target disappears. Lift VG-1 [VG-2] out of mount and put in pitch-up attitude. This will cause antenna to pitch down and target will reappear on indicators.

If difficulty is encountered in determining pitch-down attitude on weather radar indicator display, proceed as follows: Set VG-1 [VG-2] back in mount, rotate antenna tilt control (either CW or CCW) until a prominent target is displayed. Lift VG-1 [VG-2] out of mount and put in pitch-down attitude. This will cause antenna to pitch up and target will disappear.

(9) In FESC, put VG-1 [VG-2] in right-roll then left-roll attitude (fault annunciator/latitude switch side up then down).

(10) On Captains [F/O] ADI, verify ADI indicates right-roll then left-roll attitude.

(11) On Captains and First Officers weather radar indicators, verify right-roll then left-roll attitude is displayed.

NOTE: If difficulty is encountered in determining right-roll attitude on weather radar indicator display, proceed as follows: Set VG-1 [VG-2] back in mount, rotate antenna tilt control until a prominent target is displayed in the right-hand sector of the indicator display. Lift VG-1 [VG-2] out of mount and put in right-roll attitude. This will cause antenna sector scan to roll left. Previously displayed prominent target will either disappear or decrease in size and intensity, depending on range.

If difficulty is encountered in determining left-roll attitude on weather radar indicator display, proceed as follows: Set VG-1 [VG-2] back in mount. Rotate antenna tilt control until a prominent target is displayed in left-hand sector of indicator display. Lift VG-1 [VG-2] out of mount and put in left-roll attitude. This will cause antenna sector scan to roll right. Previously displayed prominent target will either disappear or decrease in size or intensity, depending on range.

(12) In FESC, install and secure VG-1 [VG-2] in mount (Ref. 34-21-04).

(13) On weather radar control panel, depress OFF switchlight (OFF legend comes on), set SYSTEM 1-2 switch to 1.

D. Vertical Gyro No. 3 Functional Test

NOTE: Captain and First Officers ALTN ATT switchlights should both be depressed during this test.

(1) On instrument source select panel located on Captains [F/O] instrument panel, depress ALTN ATT switchlight. Verify ALTN legend comes on.

(2) On pilots overhead circuit breaker panel CB1, close circuit breaker INS-3/GYRO-3 (E24) and simultaneously start timer.

R CAUTION: THE ABOVE FIVE MINUTE TIME APPLIES TO A
R TEMPERATURE OF APPROXIMATELY 20°C (68°F). IN
R EXTREME COLD CONDITIONS, GYRO SPIN UP TIME TO ATT
R FLAG OUT OF VIEW CAN BE AS LONG AS 15 MINUTES.

R (3) After five minutes, verify ATT flag on Captains [F/O] ADI is out of view, and ADI indicates 0 (±2) degrees pitch and roll. If ADI attitude display is displaced greater than 2 degrees from level, check aircraft attitude for agreement with ADI attitude display (Ref. 8-10-00).

(4) In FESC forward rack, zone 112, release captive screws securing VG-3 to mount (Ref. 34-21-04). Carefully lift VG-3 out of mount and put in pitch-up then pitch-down attitude (electrical connector down then up).

NOTE: Two men are required to perform Steps 3 D(4) through 3D(9).

(5) On Captains [F/O] ADI, verify ADI indicates pitch-up then pitch-down attitude.

(6) In FESC, put VG-3 in right-roll then left-roll atttitude (fault annunciator latitude switch side up then down).

(7) On Captains [F/O] ADI, verify ADI indicates right-roll then roll-left attitude.

(8) On Captains [F/O] instrument source select panel, depress ALTN ATT switchlight. Verify ALTN legend goes off.

(9) In FESC, install and secure VG-3 in mount (Ref. 34-21-04).

E. Shutdown

(1) Turn off electrical power (Ref. 24-00-00).

C ATTITUDE REFERENCE SYSTEM - ADJUSTMENT AND TEST

C 1. (Deleted)

C 2. Reference Procedures

C 8-10-00 Leveling - Description and Operation

C 21-25-00 Equipment Cooling - Adjustment/Test (Operational Test)

C 24-00-00 Electrical Power - Maintenance Practices

C NOTE: Following procedures only required if functional test is to be performed:

C 34-43-03 Inertial Navigation Unit - Removal and Installation

C 34-44-00 Weather Radar System - Adjustment and Test

C 3. Adjustment/Test

C A. Preparation

C NOTE: Satisfactory performance of the operational test (Para. 3B) ascertains that the INS Navigation Unit(s) and the attitude function of the ADI(s) is operable. If more detailed testing is to be performed, the procedures in the functional tests (Para. 3C and 3D) should be performed.

C (1) On pilot's overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed.

C INS-1

C VG/INS-1 (G6)

C INS PWR (E6)

C INS HTR (E7)

C INS-2

C INS/VERT GYRO (G24)

C INS HTR (G25)

R EFFECTIVITY: INS EQUIPPED AIRCRAFT

R

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C INS-3

C INS-3/GYRO 3 (E24)

C INS 3 HTR (E25)

C ALT SOURCE SEL - CAPT'S (E1) and F/O INSTR (E2)

C ALTN ADI (E19)

C CAPT ADI (F2)

C F/O ADI (F20)

C NOTE: The following circuit breakers required only if
C functional test is to be performed.

C NO. 1 NAVIGATION WEATHER RADAR - IND (D2) and RT (D3)

C NO. 2 NAVIGATION WEATHER RADAR-IND (D20) and RT (D21)

C (2) Set mode selector switch on each INS mode selector unit
C in pilot's overhead panel to OFF position.

C (3) Turn on electrical power (Ref. 24-00-00).

C (4) Verify that equipment cooling is on (Ref. 21-25-00) by
C checking FE/SO-ECS MONITOR panel; verify AVIONIC
C AIR-FWD and MID LO FLO lights are out.

C B. INS NU No. 1, 2 and 3 Operational Test

C NOTE: INS NU No. 1 tests are shown. INS-2 differences are
C shown in brackets.

C (1) Set INS No. 1 mode selector switch [INS No. 2 mode
C selector switch] (pilot's overhead panel) to ALIGN.

C (2) Set INS No. 1 control/display unit [INS No. 2
C control/display unit] data selector to DSRTK/STS and
C allow INS to align until actual PI number goes from 9
C to 7.

C NOTE: The PI number is located in position X on
C right-hand control/display unit data display
C (OYY-X5).

C (3) Verify that ATT flag on Captain's [F/O] attitude
C director indicator (ADI) located on Captain's F/O
C instrument panel zone 211 [212], is out of view, and
C that ADI indicates 0 (± 2) degrees pitch and roll. If
C ADI attitude display is displaced greater than 2

C degrees from level, check aircraft attitude for
C agreement with ADI attitude display (Ref. 8-10-00).

C (4) On INSTRUMENT SOURCE SELECT panel on both Captain's and
C F/O instrument panels depress ALTN ATT switchlight and
C verify ALTN legend comes on.

C (5) Set INS No. 3 mode selector switch (pilot's overhead
C panel) to ALIGN.

C (6) Set INS No. 3 control/display unit data selector to
C DSRTK/STS and allow INS to align until actual PI number
C goes from 9 to 7.

C NOTE: The PI number is located in position X on
C control display unit, right hand display
C (OYY-XS).

C (7) Repeat Step B(3) for captain's and F/O's attitude
C director indicators (ADI).

CR (8) Open INS3/GYRO 3 (018 thru 031) or INS 3 HTR (032 and
CR on) circuit breaker (10A). Verify that ATT flag
C appears on both captain's and first officer's ADI's.

CR (9) Close INS3/GYRO 3 (018 thru 031) or INS 3 HTR (032 and
CR on) circuit breaker (10A). Verify that ATT flag
C disappears from view on both ADI's.

C (10) Restore airplane to normal.

C (a) Set each INS mode selector switch to OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL
C CAUSE INS TO AUTOMATICALLY SWITCH TO BATTERY
C POWER AND DEPLETE BATTERY.

C (b) On INSTRUMENT SOURCE SELECT panel on both
C captain's and F/O instrument panels, depress ALTN
C ATT switchlight and verify that ALTN legend
C extinguishes.

C (c) Remove electrical power if no longer required.
C Refer to 24-00-00.

C (d) Remove equipment cooling if no longer required.
C Refer to 21-25-00.

C C. INS No. 1, No. 2 and No. 3 (Attitude) Functional Test
C Perform "Test Inertial Navigation System/ADI Interface" per
C Maintenance Manual Chapter/Section 34-43-00, Paragraph 2
C E.(6).

VERTICAL GYRO- REMOVAL AND INSTALLATION

1. Referenced Procedures

34-21-00 Attitude Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag appropriate circuit breaker for vertical gyro to be replaced: VG/INS-1 (C6), INS/VERT GYRO (G24), or INS-3/GYRO-3 (E24) for VG-1, VG-2, or VG-3 respectively.

CR CAUTION: Allow 5 minutes for gyros to run down before
CR removing unit or gimbal damage may result.
CR Use care during removal to prevent damage to
CR airflow seal. Unit should be transported
CR in its shipping container at ALL times.

(2) Open access door 112AB and enter forward electronic service center, zone 112, FS164. Locate applicable vertical attitude reference gyroscope on forward rack (Ref. Fig. 401).

(3) Disconnect mount cable connector from receptacle J1 on vertical gyro to be removed.

(4) Rotate the fluted knobs (hold-down extractors) to their fullest extent anti-clockwise to ensure the vertical gyro mount is extracted. Disengage the fluted knob securing the vertical gyro mounting to the rack mount.

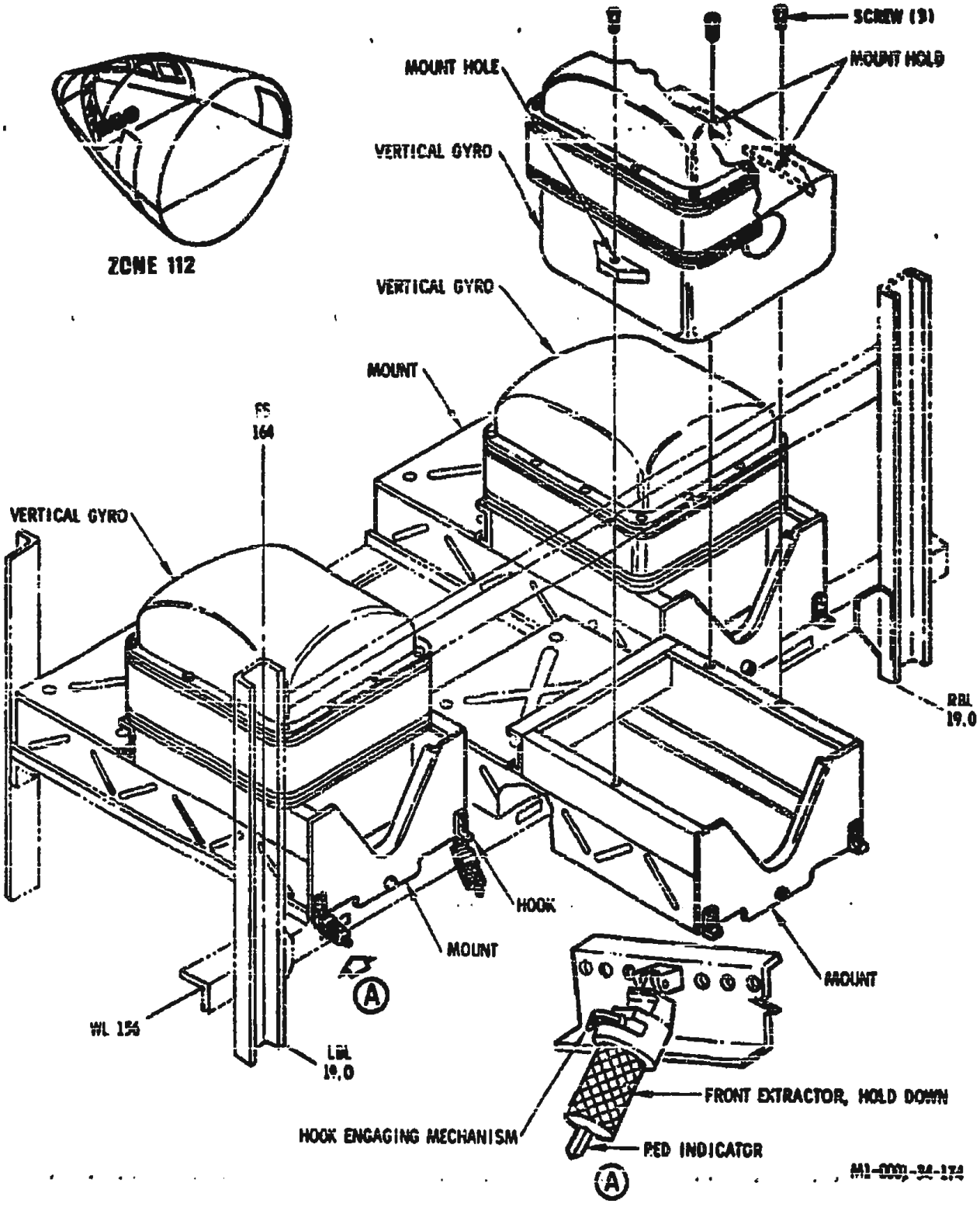
(5) Pull vertical gyro mounting out of the rack.

NOTE: Excessive force is not required if gyro mount multi-contact connectors are fully disengaged in operation (4) above.

(6) Loosen captive screws securing vertical gyro to vertical gyro mount and remove vertical gyro.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are opened and tagged.



R Vertical Gyro
R Removal and Installation
R Figure 401

EFFECTIVITY: AIRCRAFT WITH VGs

001B

(2) Position vertical gyro on mount, aligning screw holes on vertical gyro and on mount. Install and tighten captive screws.

(3) Install vertical gyro mount in rack.

(4) Place mount hold-down extractors over vertical gyro mount hooks.

(5) Tighten fluted knobs securing vertical gyro mount to the rack. The unit is correctly tightened when:

(a) the fluted knobs slip on their clutch and

(b) the red band positioned between the front of the fluted knob and the dome of the hold-down unit is no longer in view.

(6) Connect mount cable connector to receptacle J1 on vertical gyro.

(7) Close and secure access door.

(8) Remove tags and close circuit breakers opened in Step 2A(1).

C C (9) Perform operational test portion of vertical gyro adjustment and test procedure (Ref. 34-21-00).

VERTICAL GYRO MOUNT - REMOVAL AND INSTALLATION

R Refer to 34-21-04, Vertical Gyro - Removal and Installation for vertical gyro mount removal and installation procedures.

CR ATTITUDE DIRECTOR INDICATOR (ADI) - MAINTENANCE PRACTICES

CR 1. General

CR A. To prevent aircraft trim problems with attendant excessive CR fuel consumption and to meet FAR requirements, the CR inclinometer on the ADI must be accurately adjusted.

CR B. When one ADI is purported to be accurate and the other ADI CR is adjusted to match, refer to the following appropriate CR procedure.

CR C. When the ADI's must be adjusted to conform with aircraft CR level, refer to the following procedure which may be used in CR lieu of leveling the aircraft (Ref. Chapter 8) to accomplish CR inclinometer ball adjustment.

CR 2. Equipment Required:

CR A. Fixtures Kit 34-20-03-0016-1

CR 3. Adjust Inclinometer - Compare Indicators (Refer to Fig. 201)

CR A. Place a 34-20-03-0016-15 overlay into the bezel of the CR reference ADI. Carefully observe the position of the CR inclinometer ball, preferably to the nearest quarter of a CR degree.

CR NOTE: A one degree sideslip can cause excessive fuel CR consumption.

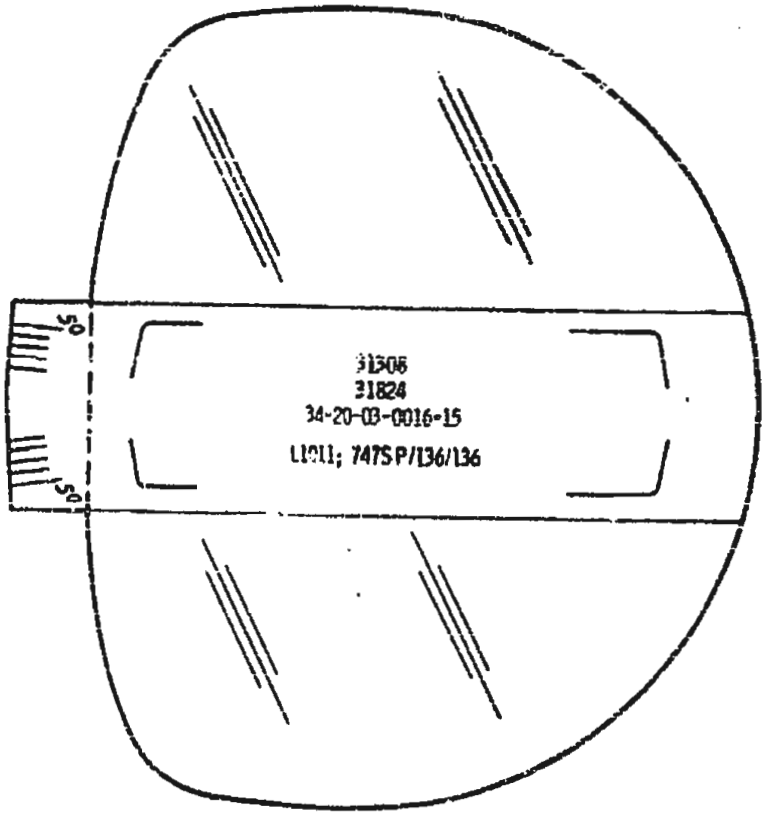
CR B. Place the overlay into the bezel of the ADI to be adjusted. CR Loosen the inclinometer mounting screws and adjust the ball CR position to coincide with the reference ADI.

CR NOTE: Strive for quarter degree accuracy.

CR Tighten the inclinometer mounting screws and recheck CR for accuracy.

CR 4. Adjust Inclinometer - Using Attitude Fixture (Refer to Fig. 202)

GR A. Pull the circuit breakers to deactivate the No. 1 VG (INS) CR attitude reference system and carefully remove the No. 1 VG CR (INS).


SD
SD
31306
31824
34-20-03-0016-15
L1011; 747SP/136/136

C B. Install a 34-20-03-0016-2 attitude fixture in place of the
C VG (INS) and note the aircraft attitude, preferably to the
C nearest quarter of a degree.

C NOTE: A one degree sideslip can cause excessive fuel
C consumption.

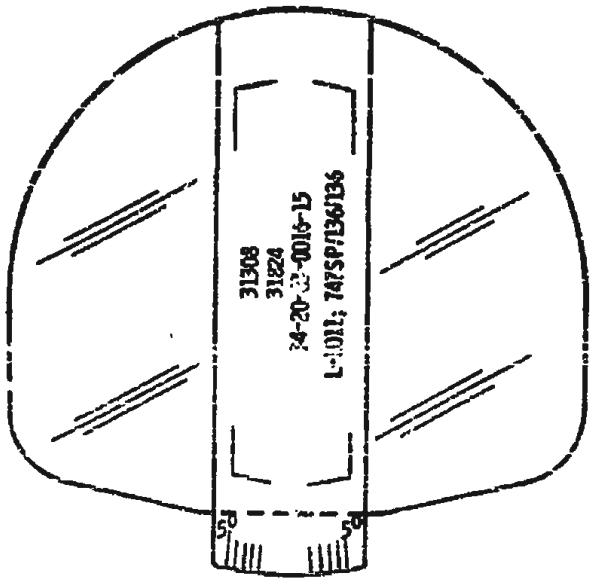
C C. Place a 34-20-03-0016-15 overlay into the bezel of the ADI
C to be calibrated. Loosen the inclinometer mounting screws
C and proceed to adjust as follows:

C (1) For example, if the fixture inclinometer shows TWO
C degrees RIGHT WING DOWN by deflecting TWO DEGREES TO
C THE LEFT OF ZERO, adjust the ADI inclinometer until the
C right edge of the ball just touches the TWO degree
C RIGHT-HAND calibration mark on the overlay.

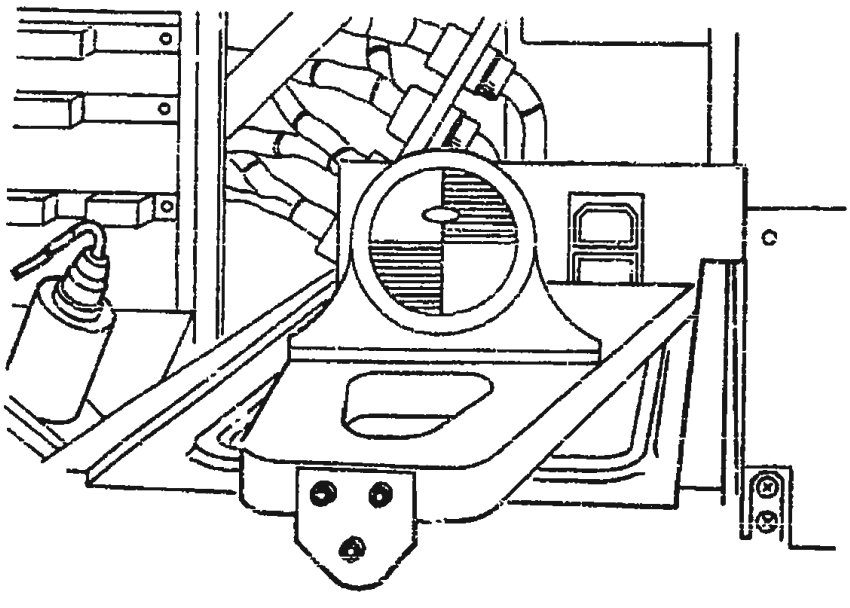
C D. Tighten the inclinometer mounting screws and recheck
C accuracy.

C E. Remove the overlay and attitude fixture and stow in their
C kit container.

C F. Install the No. 1 VG (INS), activate the system circuit
C breakers and cherk to see that system operation is normal.



OVERLAY



ATTITUDE FIXTURE

MI-G001-34-3660

CR
CR

Inclinometer Adjustment Tools
Figure 202

R EFFECTIVITY: ALL
R
001B

ATTITUDE DIRECTOR INDICATOR (ADI) - REMOVAL AND INSTALLATION

1. Referenced Procedures

22-12-03	FD Basic Mode - Adjustment and Test
22-12-21	FD Approach Mode - Adjustment and Test
22-31-00	Speed Control System - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
34-21-00	Attitude Reference System - Adjustment and Test
34-32-00	Radio Altimeter System - Adjustment and Test
34-33-00	Instrument Landing System - Adjustment and Test
34-35-00	Marker Beacon System - Adjustment and Test
34-43-00	Inertial Navigation System - Adjustment and Test (aircraft with inertials installed)

2. Removal/Installation

NOTE: The ADI has proven to be susceptible to high ambient temperatures. Therefore it is recommended that whenever L-1011 Aircraft are on the ground for one (1) hour or more the master radio bus switches be turned off and the ADI circuit breakers be pulled under the following conditions:

R (1) The outside air temperature is above 80-degrees F. and the APU and at least one air condition pack are operating.

R (2) The outside air temperature is above 65-degrees F. and no packs are operating.

R The above does not apply if systems are needed for testing or functional checking.

A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers as applicable to Captain or F/O ADI:

CAPT ADI (F2)

CAPTS INSTR (E1)

F/O ADI (F20)

F/O INSTR (E2)

CAPT L (L20) orF/O R (L35)

(2) Turn electrical power ON (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR LOCK SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF ALL PERSONNEL.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

PLACARD HYDRAULIC PANEL - DO NOT TURN OFF.

(3) Pressurize a hydraulic power system (Ref. 29-11-00) and placard hydraulic panel.

(4) Pull control column full aft and tie to seat or other structure.

(5) Locate Captains ADI at Captains instrument panel, zone 211, and First Officers ADI at First Officers instrument panel, zone 212 (Ref. Fig. 401).

(6) Loosen clamp screws securing ADI to Captains or First Officers instrument panel.

(7) Pull ADI out of recess in Captains or First Officers instrument panel and disconnect connectors from receptacles. Remove ADI.

C NOTE: Only one ADI should be removed at a time. When
CR installing an ADI, its inclinometer should be
CR checked/adjusted to match the roll attitude
C indicated by the inclinometer of the ADI that
C was left in place.

C If both ADI have to be removed at the same time,
C or if inclinometer adjustments on both ADI are
C in doubt, it is necessary to adjust both

C inclinometers. Refer to Attitude Direction
C Indicator - Maintenance Practices.

B. Installation

(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) On FE/SO overhead circuit breaker panel CB2, zone 215, verify INSTR COOLING (A21) circuit breaker is closed.

(3) Turn electrical power ON (Ref. 24-00-00).

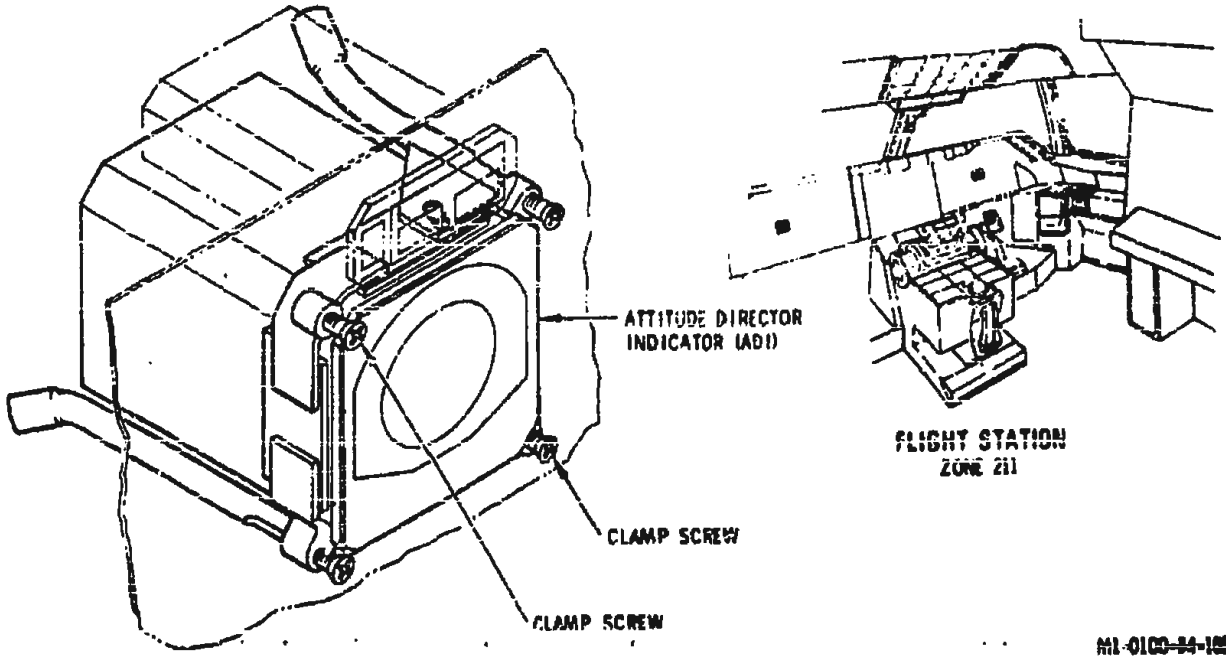
WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR LOCK SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF ALL PERSONNEL.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

PLACARD HYDRAULIC PANEL - DO NOT TURN OFF.



M1-0100-34-1059

R Attitude Director Indicator (ADI)
R Removal and Installation
R Figure 401

(4) Pressurize a hydraulic system (Ref. 29-11-00) and placard hydraulic panel.

(5) Reach through instrument panel opening and feel for airflow from instrument cooling system.

Air flow is from tubes at upper right and lower left corners of instrument clamp behind panel.

(6) Pull control column full aft and tie to seat or other structure.

(7) Connect connectors to receptacles on rear of ADI.

(8) Position ADI in recess on Captains or First Officers instrument panel, slide into position, and secure by tightening clamp screws with a tightening torque between 5 and 8-inch pounds.

CAUTION: EXCESSIVE TIGHTENING WILL DAMAGE INDICATOR AND CAUSE MALFUNCTION.

(9) Untie control column.

(10) Remove tags and close circuit breakers opened in Step 2A(1).

(11) Turn hydraulic power OFF (Ref. 29-11-00).

(12) Remove hydraulic panel placard.

R 3. ADI Inclinometer Adjustment

R A. Leveling Aircraft

R (1) Level per Chapter 8-11-00, 201.

R B. Inclinometer Adjustment

R (1) Loosen either of the two screws on either end of
R inclinometer.

R (2) Move applicable end up or down to center bubble.

R (3) Tighten inclinometer screws.

R (4) Secure aircraft leveling.

CR 4. Post-Installation Test (VG Equipped Aircraft)

C NOTE: See 34-21-07, Page 501 for INS equipped aircraft.

A. Attitude Test

(1) On pilots overhead circuit breaker panel CB1, verify following circuit breakers are engaged:

Capt ADI (F2) if Capt ADI was replaced, or F/O ADI (F20) if F/O ADI was replaced. Verify that attitude reference system circuit breakers on CB1 panel are engaged.

(2) Turn electrical power ON (Ref. 24-00-00).

(3) On FE/SO-ECS MONITOR panel, verify AVIONIC AIR - FWD, MID and INS COOLING LO FLO lights are out.

Attitude Reference System No. 1 test (for Capt ADI) is shown. Attitude Reference System No. 2 test (for F/O ADI) is shown in brackets.

CAUTION: IF ELECTRICAL POWER HAS BEEN OFF VERTICAL GYRO FOR 90-SECONDS OR MORE, POWER SHOULD REMAIN OFF FOR AT LEAST 10-MINUTES TO ASSURE PROPER ERECTION OF GYRO UPON REAPPLICATION OF POWER.

(4) On aircraft with inertials installed, place inertial mode switch on mode selector panel to ATT mode.

(5) After 5-minutes, verify ATT flag on Capt (F/O) ADI is out of view, and ADI indicates 0 (±2)-degrees pitch and roll. If ADI attitude display is displaced greater than 2-degrees from level, check aircraft attitude for agreement with ADI attitude display (Ref. 8-10-00).

(6) On INSTRUMENT SOURCE SELECT panel on both Capt and F/O instrument panels, press ALTN ATT switchlight and verify ALTN legend comes on.

(7) If 5-minutes has passed, check that indications are the same as Step (5).

B. Flag and Indication Checks

NOTE: It is assumed a good, functionally checked indicator has been used as a replacement. The primary function of the ADI is to indicate attitude; however, having other functions as well, the following procedure will check flags and indications for operation or correct indication

as aircraft sits on ground. For more comprehensive testing, if required, refer to appropriate adjustment and test procedures at beginning of procedure.

(1) Verify ALTN ATT switchlights on Instrument Source Select panels are de-energized, ATT light OFF.

(2) Verify circuit breakers associated with ADIs, attitude reference systems, APFDS, Speed Control System, ILS, VOR, Radio Altimeter and Marker Beacon system are engaged.

(3) Verify FD switch "A" and "B" on APFDS ENGAGE panel are OFF.

(4) Verify ATS-1 or ATS-2 switchlight on FCES control panel is ON.

(5) All flags must be out of view, all pointers and command bars should be out of view except SLOW-FAST pointer. The radio altitude indicator must be unshuttered indicating 0-feet.

(6) Press ATS-1 or ATS-2 switchlight to OFF. SLOW-FAST pointer should go out of view. Flag will be out of view at all times. Disabling Speed Control Computer will put flag in view.

(7) Open, as required, ADI (F2) or ADI (F20) circuit breaker. All flags, except SLOW-FAST, must be in view. All pointers and command bars will be out of view. The radio altitude indication will be shuttered. Check marker lights by actuating Lights Test switchlight on pilots overhead panel.

(8) If further tests are required, refer to references at front of procedure.

CAUTION: INERTIAL SYSTEM BATTERIES MAY DISCHARGE UPON POWER REMOVAL IF INERTIAL SYSTEMS ARE NOT TURNED OFF.

(9) Turn electrical power OFF (Ref. 24-00-00).

ATTITUDE DIRECTOR INDICATOR - ADJUSTMENT/TEST

1. Attitude Director Indicator Test (INS Equipped Aircraft)

A. General

(1) Two attitude director indicators (ADI) are installed in the airplane, one on each pilot's instrument panel. Each ADI is electrically connected by two connectors in the rear of the unit. This test provides a rapid check to verify that both electrical cables are properly connected to the ADI.

B. Referenced Procedures

(1) 21-25-00, Equipment Cooling - Adjustment/Test (Operational Test)

(2) 24-00-00, Electrical Power - Maintenance Practices (Apply Power)

C. Prepare for Test

(1) Set mode selector switch on each INS mode selector unit in pilots' overhead panel to OFF position.

(2) Provide electrical power. Refer to 24-00-00.

(3) Provide cooling air to INS equipment. Refer to 21-25-00.

CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF NAVIGATION UNITS.

(4) Close all INS, ADI and ALT SOURCE SELECT circuit breakers on electronic circuit breaker panel CB1.

D. Test Attitude Director Indicator

NOTE: This procedure uses INS No. 3 in order that both the captain's and first officer's ADI's can be tested simultaneously.

(1) Set INS No. 3 mode selector switch (pilots' overhead panel) to ALIGN.

(2) Set INS No. 3 control/display unit data selector to DSRTK/STS and allow INS to align until actual PI number goes from 9 to 7.

NOTE: The PI number is located in position X on right-hand control/display unit data display (OYY-X5).

(3) Set both captain's and first officer's ATT ALTN switches to ALTN (depressed) position. Verify that both ADI's indicate 0 degrees pitch and roll and that both attitude flags are out of view.

(4) Open INS3/GYRO 3 circuit breaker. Verify that attitude flag appears on both captain's and first officer's ADI's.

(5) Close INS3/GYRO 3 circuit breaker. Verify that attitude flag disappears from view on both ADI's.

(6) Return captain's and first officer's ATT ALTN switches to NORM (released).

E. Restore Airplane to Normal.

(1) Set each INS mode selector switch to OFF position.

CAUTION: FAILURE TO MORE MODE SELECTOR TO OFF WILL CAUSE INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND DEPLETE BATTERY.

(2) Remove electrical power if no longer required. Refer to 24-00-00.

(3) Remove equipment cooling if no longer required. Refer to 21-25-00.

MAGNETIC HEADING REFERENCE SYSTEM (MHRS) DESCRIPTION AND OPERATION

1. General

The magnetic heading reference system (MHRS) provides stabilized magnetic heading information (MAG mode), or inertial navigation platform (aircraft with INS) or directional gyro heading information (DG mode) for display on flight station instruments. It also supplies the the Auto Flight Control System (AFCS) for autopilot and flight director functions (Ref. 22-00-00), the vertical gyros on aircraft without inertials as a correction factor, the VOR system (Ref. 34-55-00), the digital flight data recorder (Ref. 31-31-00), and the aircraft integrated data system (AIDS) (Ref. 31-32-00).

NOTE: For maintenance action regarding shipment of magnetic materials, see Ground Service Manual/Marketing, page 05.42.06.

The MHRS is comprised of two complete, functionally separate compass systems (Ref. Fig. 1). Each system consists of a flux valve and its remote compensator, a compass coupler, platform heading input from the inertial system (Ref. 34-43-00) on aircraft with inertials, or gyro heading from the directional gyro (DG) on aircraft without inertials, a compass controller, and one heading coupler accessory unit used by both systems. A flux valve is located at the outer end of each wing, zones 535 and 635; the compass controllers are in the flight compartment overhead panel, zone 210; all other components are located in the forward electronics service center (FESC), zones 112 and 113.

Heading is displayed on compass cards of radio digital distance magnetic indicators (RDDMI) (Ref. 34-57-00) and horizontal situation indicators (HSI) (Ref. 34-55-00) located on Captains and First Officers instrument panels, zones 211 and 212.

Each system requires 115V ac, 400-Hz power to the compass couplers, and 26V ac, 400-Hz power for compass coupler output synchro excitation. System No. 1 receives power from the ac standby bus, Phase A, and instrument transformers No. 1 and No. 2. System No. 2 receives power from the ac bus No. 2 extension, Phase B, and instrument transformer No. 3. All circuit breakers are located on the pilots overhead circuit breaker panel CB1, zone 210. The instruments, AFCS, inertial navigation systems, vertical gyros (aircraft without INS) and digital flight data recorder have their own separate power sources. Synchro excitation for the clutched heading synchro to the autopilot and

heading synchro output to vertical gyro No. 3 (aircraft without INS) are provided by those systems.

2. Operation

The systems (Ref. Fig. 2) have two modes of operation identified
R as MAG (magnetic) and DG (directional gyro). In MAG mode, gyro
R (DG), or platform (inertial) heading output is automatically synchronized to flux valve output in the compass coupler. The purposely slowed rate of servo slaving in this mode acts to stabilize flux valve information, which provides a smoothed magnetic heading output. In DG mode, flux valve excitation is
R removed, and gyro (DG), or platform (inertial) heading output is used, resulting in grid heading-type information. used, resulting in grid heading-type information. A SET HDG (heading) control on the compass controller permits manual alignment of the system to any desired heading.

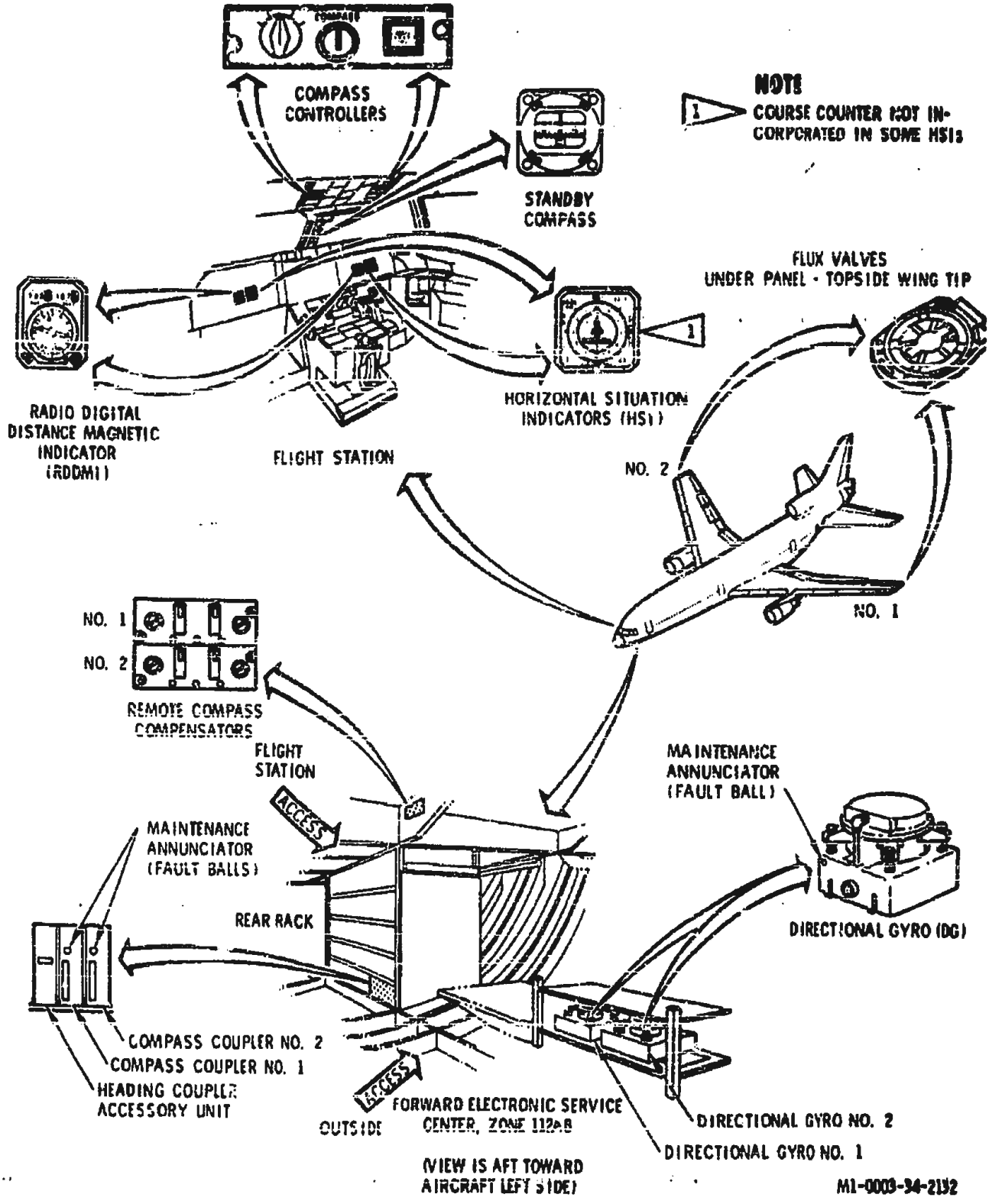
Each system provides outputs from eight isolated synchros. One output from each system is clutch-controlled for an autopilot heading hold function. System interface is shown in Figure 2.

Compass systems are cross-connected to the flight instruments as follows: Compass system No. 1 drives the Captains HSI and the First Officers RDDMI; system No. 2 drives the First Officers HSI and Captains RDDMI providing a direct comparison of the two system headings on each instrument panel.

R HSI inputs can be switched so either compass system drives both instruments. An ALTN HDG switchlight on each INSTRUMENT SOURCE SELECT panel allows the Captains HSI to be switched to compass system No. 2 or First Officers HSI to be switched to compass system No. 1 with switching taking place in the heading coupler accessory unit. The switching relays are electrically interlocked so both HSIs

HSIs may also be switched from magnetic to true heading. The RADIO/INS switchlight on the forward center console controls the mag/true heading relays in the NAV accessory unit.

R Monitor circuits in theInertial or DG unitsand compass couplers provide indications of system condition through 28V dc superflag outputs to control indicator warning flags,VG-3 magnetic heading (A/C without INS) input switching (only from system No. 1), and autopilot heading hold synchro clutch engagement. Absence of 28V dc indicates a system failure.



C C Magnetic Heading Reference System
Figure 1

R EFFECTIVITY: ALL

R 0038

R 3. Flux Valve (FV)

R A flux valve is located at the extremities of each wing, No. 1 system in the left wing and No. 2 in the right.

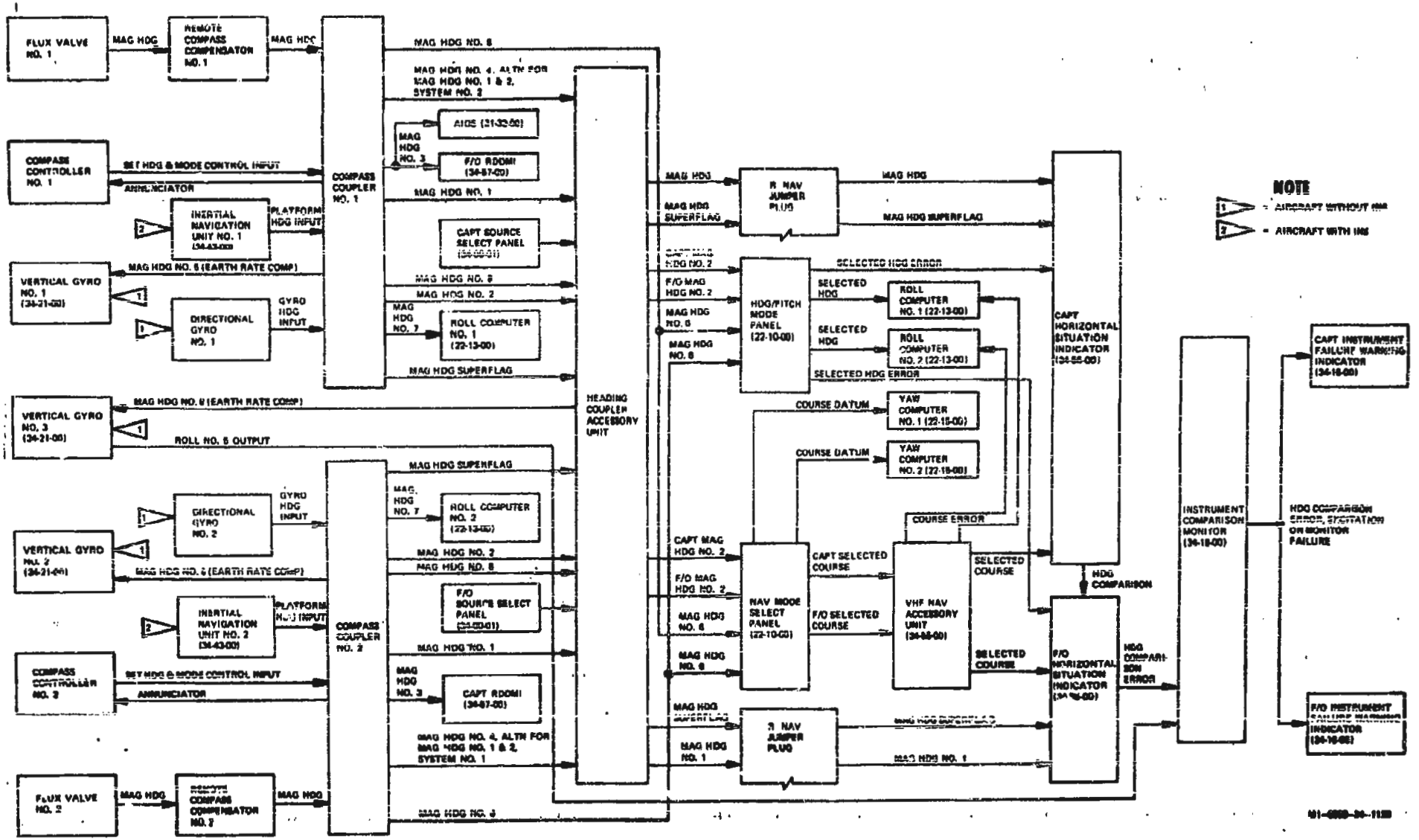
If the system is in MAG mode, the flux valve is excited with 23.5V ac, 400-Hz power applied to the primary coil. The applied power causes the metallic spider core to saturate and unsaturate 800-times per second (each time excitation passes through a peak and null). Each time the core unsaturates (excitation voltage passes through null), its reluctance to magnetic fields is lowered, each time the core saturates its reluctance increases. Since reluctance of ferrous metals is less than air, lines of flux of the earths magnetic field will tend to bend and go through the core. When the core saturates and its reluctance increases, it tends to repel the magnetic lines of flux (straightens them out), when it unsaturates and its reluctance decreases, lines of magnetic flux again bend to go through the core.

A secondary coil placed near the core senses this bending and unbending of lines of flux as a changing magnetic field which induces an 800-Hz signal into the secondary. The level of induced voltage is dependent on alignment of the secondary coil with respect to earths magnetic field. The secondary consists of three coils placed at 120-degrees with respect to each other. The coils position in the flux valve is such that 400-Hz primary excitation will cancel itself out. This leaves three 800-Hz signals in the three legs of the secondary which, when combined, will give a voltage and phase relationship corresponding to alignment of the secondary coils with respect to earths magnetic field (similar to three legs of a synchro stator). This signal is corrected by the remote magnetic compensator for magnetic heading errors due to aircraft structure and applied to the stator of the flux valve control transformer (FV CT) in the compass coupler.

R 4. Remote Magnetic Compensator

The remote magnetic compensators are located in the FESC, one above the other just below the left, aft corner of the flight compartment access.

It is the sole compass system compensating device and compensates for magnetic heading errors due to aircraft structure. It accomplishes this by inducing a set fixed voltage through the flux valve stator windings.


FLUX VALVE NO. 1
MAG HDG
REMOTE COMPASS COMPENSATOR NO. 1
MAG HDG
COMPASS COUPLER NO. 1
MAG HDG NO. 6
MAG HDG NO. 4, ALTN FOR MAG HDG NO. 1 & 2, SYSTEM NO. 2
AIDS (31-32-00)
MAG HDG NO. 3
F/O RDDMI (34-67-00)
COMPASS CONTROLLER NO. 1
SET HDG & MODE CONTROL INPUT
ANNUNCIATOR
INERTIAL NAVIGATION UNIT NO. 1 (34-43-00)
PLATFORM HDG INPUT
CAPT SOURCE SELECT PANEL (34-66-01)
MAG HDG NO. 1
VERTICAL GYRO NO. 1 (34-21-00)
MAG HDG NO. 5 (EARTH RATE COMP)
DIRECTIONAL GYRO NO. 1
GYRO HDG INPUT
MAG HDG NO. 2
MAG HDG NO. 7
ROLL COMPUTER NO. 1 (22-13-00)
MAG HDG SUPERFLAG
VERTICAL GYRO NO. 3 (34-21-00)
MAG HDG NO. 6 (EARTH RATE COMP)
ROLL NO. 6 OUTPUT
HEADING COUPLER ACCESSORY UNIT
DIRECTIONAL GYRO NO. 2
VERTICAL GYRO NO. 2 (34-21-00)
INERTIAL NAVIGATION UNIT NO. 2 (34-43-00)
COMPASS CONTROLLER NO. 2
COMPASS COUPLER NO. 2
F/O SOURCE SELECT PANEL (34-66-01)
CAPT RDDMI (34-67-00)
FLUX VALVE NO. 2
REMOTE COMPASS COMPENSATOR NO. 2
MAG HDG NO. 4, ALTN FOR MAG HDG NO. 1 & 2, SYSTEM NO. 1
MAG HDG NO. 3
MAG HDG
MAG HDG SUPERFLAG
R NAV JUMPER PLUG
HDG/PITCH MODE PANEL (22-10-00)
F/O MAG HDG NO. 2
SELECTED HDG
SELECTED HDG ERROR
ROLL COMPUTER NO. 1 (22-13-00)
ROLL COMPUTER NO. 2 (22-13-00)
COURSE DATUM
YAW COMPUTER NO. 1 (22-15-00)
YAW COMPUTER NO. 2 (22-15-00)
COURSE ERROR
CAPT MAG HDG NO. 2
NAV MODE SELECT PANEL (22-10-00)
CAPT SELECTED COURSE
F/O SELECTED COURSE
VHF NAV ACCESSORY UNIT (34-55-00)
SELECTED COURSE
CAPT HORIZONTAL SITUATION INDICATOR (34-55-00)
HDG COMPARISON
F/O HORIZONTAL SITUATION INDICATOR (34-55-00)
HDG COMPARISON ERROR
INSTRUMENT COMPARISON MONITOR (34-18-00)
CAPT INSTRUMENT FAILURE WARNING INDICATOR (34-18-00)
HDG COMPARISON ERROR, EXCITATION OR MONITOR FAILURE
F/O INSTRUMENT FAILURE WARNING INDICATOR (34-18-00)
NOTE
1 = AIRCRAFT WITHOUT INS
2 = AIRCRAFT WITH INS

R Magnetic Heading Reference System Block Diagram
R Figure 2

EFFECTIVITY: ALL

003B

R 5. Compass Controller

The compass controller provides a means of selecting a set heading. There are two identical compass controllers, one for the Captain, and one for First Officer. They are mounted in the pilots overhead panel, zone 210. A single electrical connector provides 5V ac panel edge lighting, 28V dc lamp power, and system interface. The front panel contains a SET HDG knob, a MAG/DG switchlight, and annunciator. The SET HDG knob is used to control MAG or DG mode causing the compass coupler servo loop to drive CW or CCW at fast or slow rates. The MAG/DG switchlight is a push-to-switch type and selects magnetic heading or DG mode of operation for the compass coupler servo loop. The annunciator is a null meter which deflects 45-degrees CCW when a current of 500-milliamperes is applied. A current of opposite polarity deflects the meter CW.

The annunciator on each compass controller provides an indication of slaving operation. When the system is in MAG mode, the annunciator repeats information from the compass coupler to indicate direction and relative magnitude of the difference between the gyro heading and flux valve-sensed magnetic heading.

R 6. Compass Coupler

The coupler consists of two plug-in printed circuit boards, a dual servomechanism assembly and a power supply housed in a one-quarter ATR short case. All electrical connections to the coupler are through two connectors at the rear. The coupler provides two remotely controlled modes of operation, MAG and DG (Ref. Fig. 3). In MAG mode, a dual-entry servo loop tracks the input from the gyro directly (6000-degrees per minute), but input from the flux valve is tracked at a slower controlled rate. Synchronization of the servo loop to the inputs can be automatically or manually controlled at several tracking rates as follows:

- Fast Synchronization

The servo loop automatically synchronizes to flux valve input at 600- to 800-degrees per minute when power is first applied, when MAG mode is first selected, or when the servo loop is more than 2-degrees out of sync with flux valve input. If the SET HDG control is moved out of center position, the flux valve input is interrupted and the servo loop is switched to manual control. The servo loop reverts to automatic sync when the SET HDG control is released.

- Normal (slow) Synchronization

The servo loop automatically synchronizes to flux valve input at 1- to 2-degrees per minute when synchronized to within 2- degrees of flux valve input and none of the conditions in fast synchronization are present.

- Manual Synchronization

The servo loop is driven CW or CCW at either a fast or slow rate when the SET HDG knob on the compass controller is moved out of center position. The fast rate is 800- to 1200-degrees per minute and slow rate is 40- to 80-degrees per minute.

R Any change in platform heading (inertial), or gyro (DG) input is summed with the flux valve or SET HDG input in the input control differential transformer (CDX), the resolved difference is applied to the servo control transformer (CT).
R When the input signal is nulled, control of the servo loop reverts to the flux valve/SET HDG input.

When DG mode is selected, flux valve input is interrupted
R and the servo loop is controlled by the platform heading
R (inertial), or gyro (DG) heading and the SET HDG inputs.

A. Monitoring

Internal monitoring circuits control a 28V dc superflag signal a latching maintenance monitor, and autopilot output synchro clutch. The following functions are monitored:

R (1) Platform heading (inertial), or gyro (DG) heading warning signals(2) Flux valve excitation current

(3) 115V ac, 400-Hz input power

(4) Followup servomechanism error

(5) Fast sync mode activated

(6) SET HDG mode activated

(7) Stepper motor excitation

The warning flags labelled HDG are located at the top of each RDDMI and HSI.

The latching maintenance monitor is located on the front of the coupler.

Indicator warning flags appear, the VG-3 magnetic heading input is switched (from system No. 1 only), and the autopilot synchro clutch disengages if the condition of

Steps 5A(1), 5A(2), 5A(3), or 5A(7) is missing; if Step 5A(4) is more than 2-degrees, or Step 5A(5) or 5A(6) are present. the autopilot synchro clutch disengages if the condition of Steps 5A(1), 5A(2), 5A(3), or 5A(7) is missing; if Step 5A(4) is more than 2-degrees, or Step 5A(5) or 5A(6) are present. If condition 5A(4) persists, or if the servo CT rotor opens, warning flags and autopilot clutch disengagement are accompanied by latching of the maintenance monitor annunciator to a yellow indication.

R 7. Operation

Figure 3 shows primary signal flow of the servo loop required to align (synchronize) the dual-entry servo loop to magnetic heading input when the coupler is in MAG mode. When the servo loop is aligned, synchro transmitters B1 through B6 and B8 provide magnetic heading outputs to external systems. Synchro transmitter B7 transmits steering information to the autopilot when the clutch is engaged. The clutch is engaged by 28V dc from the autopilot and ground controlled by the compass coupler monitor.

R The servo loop uses magnetic heading and platform heading
R (inertial), or gyro (DG) heading signals in MAG mode. The three-wire, 800-Hz magnetic heading signal is applied to flux
R valve control transformer (FV CT). The three-wire, 400-Hz
R platform heading (inertial), or gyro (DG) heading signal is applied to the stator of control differential transformer (CDX). The output of the FV CT (heading error) is converted to a series of pulses whose frequency represents the amount of heading error. The direction of heading error is converted to logic one or zero.

Heading error pulses are combined with the logic signal to provide four-wire rate and direction information for the stepper motor. This rate and direction information causes the stepper motor to rotate and turn the rotor of the CDX. The differential of the electrical gyro input and the mechanical magnetic input is applied to the stator of the servo CT. The servo CT rotor output is applied to a servo amplifier that limits the signal, amplifies it and applies it to the servo motor to position rotors of the servo CT and FV CT. The motor continues to drive until the rotor of the servo CT reaches a position which nulls the servo loop. The rotor of the servo CT cannot reach a null position until both inputs to the CDX become stable. Therefore, the motor continues to drive as long as the flux valve magnetic heading or gyro input is changing, or the FV CT is not at null. The normal slaving rate at which the stepper motor input causes the servo loop to align to magnetic input is between 1- and 2-degrees per minute. A means of aligning the servo loop to the FV CT is provided by fast synchronization circuits.

R When the coupler is operating in DG mode, magnetic heading error information is disabled, and changes in three-wire information to the FV CT do not cause the servo motor to drive. operation
R of the servo loop due to platform heading (inertial), or gyro
R (DG) heading inputs is the same as in MAG mode, except after the SET HDG control is returned to center, the servo loop stops driving and does not revert to automatic synchronization.

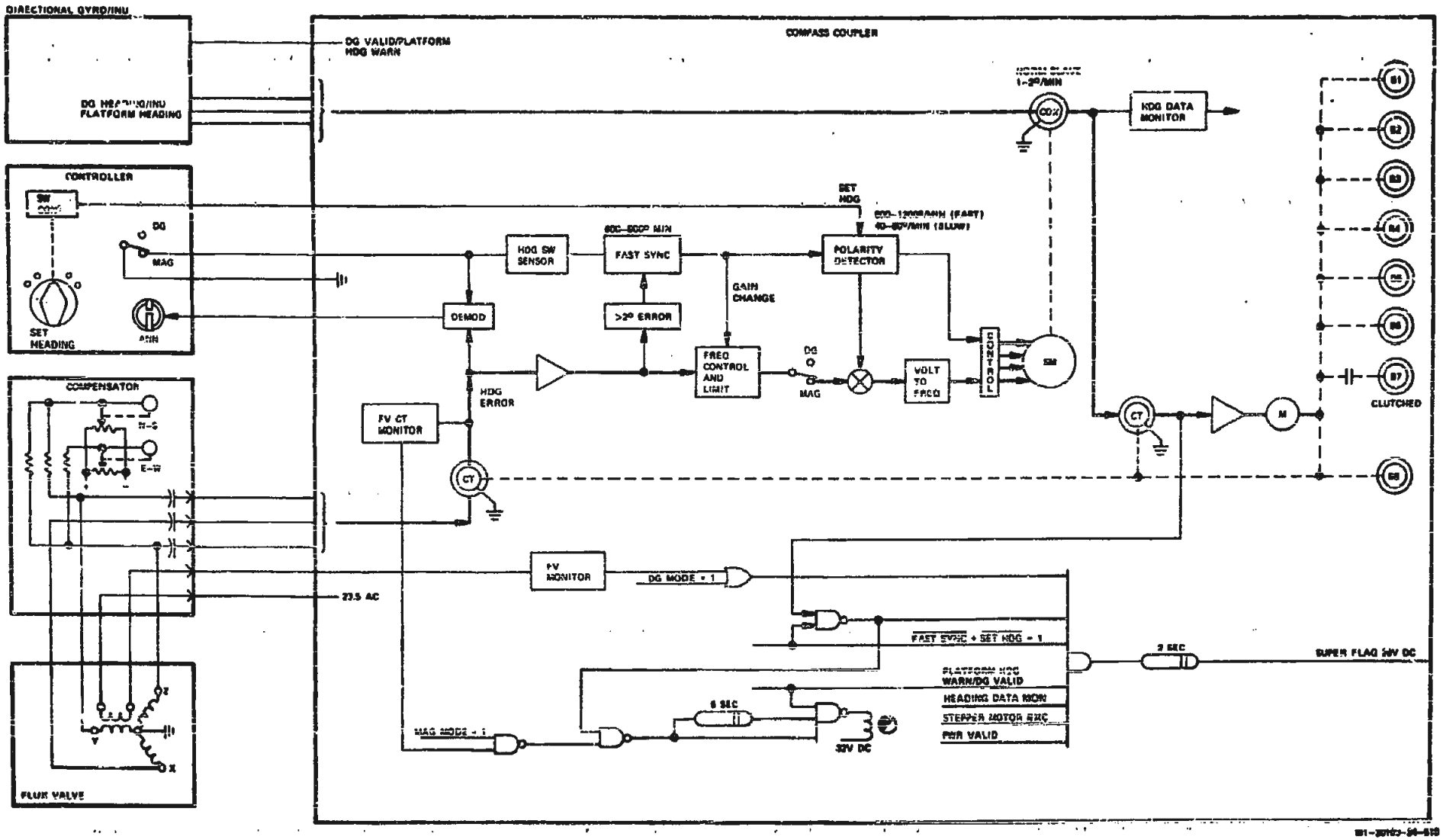
The SET HDG control can be used in either MAG or DG mode to drive the servo loop CW or CCW at fast or slow rates. Circuits in the compass coupler convert the SET HDG voltage from the controller into a series of pulses and a direction logic signal which causes the servo loop to drive as in the MAG mode. As long as a SET HDG voltage is applied, the servo loop drives in the selected direction and at the selected rate. Selecting a slow SET HDG rate drives the servo loop at 40- to 80-degrees per minute. A fast SET HDG rate selection drives the servo loop at 800- to 1200-degrees per minute. In MAG mode, the system will revert to automatic synchronization - fast or normal - as soon as the SET HDG control is released, but in DG mode the heading will remain where it is when the control is released.

R 8. Heading Coupler Accessory Unit

The heading coupler accessory unit provides relays necessary for alternate switching of flight director (Ref. 22-11-00, 22-13-00) and headingTwo relays located on the heading relay board are energized by the data valid (superflag) +28V dc signal from compass coupler No. 1. This supplies magnetic heading (No. 8) information to VG-3 on aircraft without INS from compass coupler No. 1. If a fault occurs in MHRS No. 1, the compass coupler No. 1 data valid (superflag) +28V dc signal is inhibited and the relays deenergize. With the relays deenergized, magnetic heading (No. 8) information is supplied by compass coupler No. 2.

R 9. Standby Magnetic Compass

The standby magnetic compass continuously indicates aircraft heading with respect to earths magnetic field. The compass is mounted on the windshield center divider bar. The compass is used as a standby instrument. A light on the front of the compass provides illumination for night use. The light is illuminated by the 28V dc bright/dim bus. Control of lighting is by a magnetic compass rheostat located on the interior lights panel in the pilots overhead panel, zone 212.



Magnetic Heading Reference System Functional Diagram
Figure 3

R 10. Horizontal Situation Indicator

See 34-55-00, Description and Operation

R 11. To Operate System

The system is put into operation by providing power to the ac standby, essential and No. 2 extension buses (Ref. 24-51-00) and closing the necessary circuit breakers on the pilots overhead circuit breaker panel CB1, zone 210.

MAGNETIC HEADING REFERENCE SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code, the code number can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to
R supplement fault diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide component locations for Magnetic Heading Reference System and associated components.

Fault Isolation Diagrams and Schematics List
Table 101

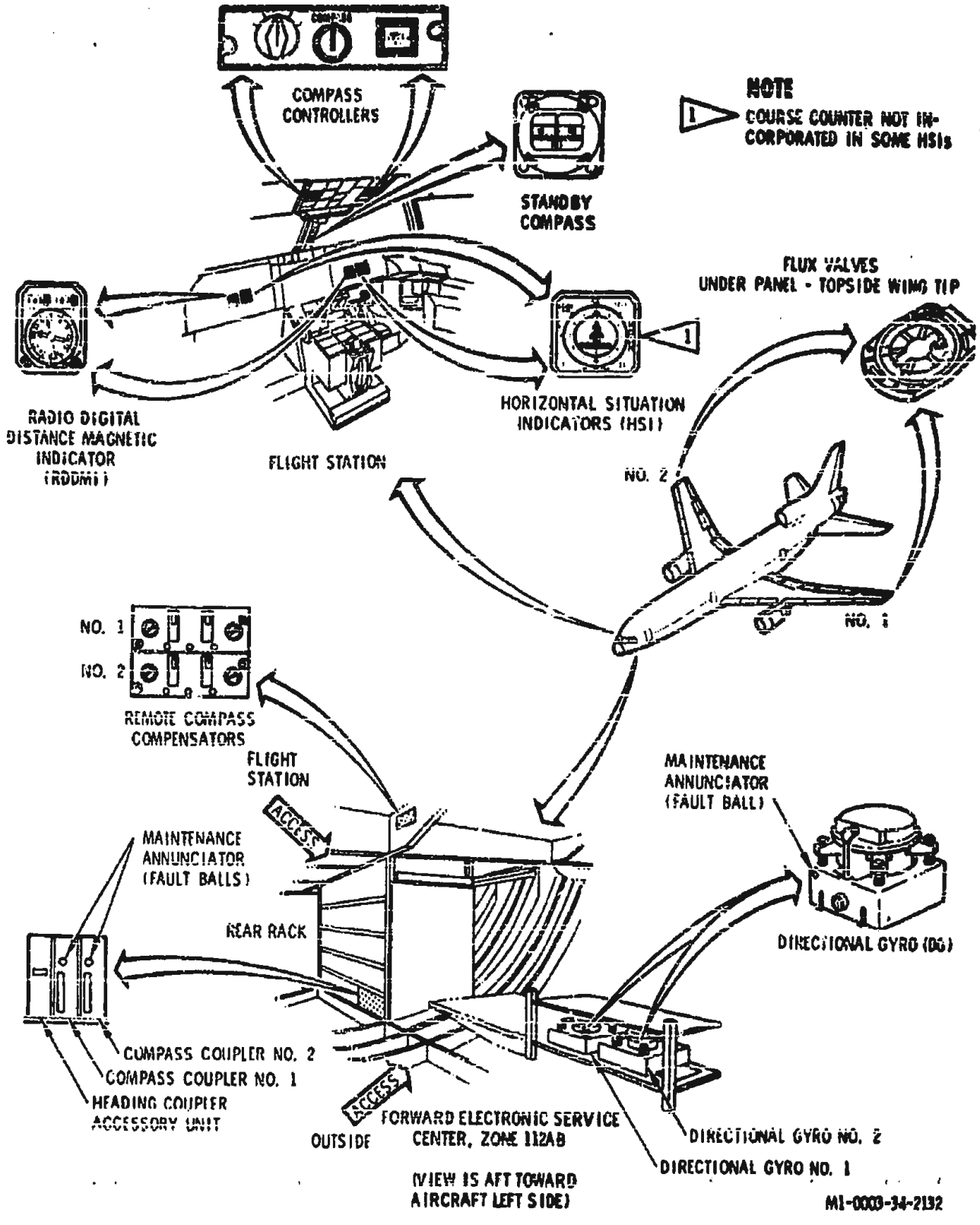
	FIGURE	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103 (Sheets 1 and 2)	Heading System Faults
	SCHEM 1 (Sheets 1 and 2)	MHRS No. 1 Schematic
	SCHEM 2 (Sheets 1 and 2)	MHRS No. 2 Schematic
	SCHEM 3 (Sheet 1)	MHRS Schematic (ALTN Switching)
	SCHEM 3 (Sheet 2)	MHRS Schematic (NAV Mode Pnl - VHF NAV Access Unit)
R R	SCHEM 4	MHRS Schematic RADIO/INS Switching - NAV Access Unit (INS Equipped Aircraft)
R	SCHEM 5	MHRS Schematic (HSI) (INS Equipped Aircraft)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPASS – STANDBY MAGNETIC	1	FLT STA, WINDSHLD CTR POST	34-22-07
COMPENSATOR – REMOTE COMPASS	2	FESC, CEILING/112AB	34-22-01
CONTROLLER – COMPASS	2	FLT STA, PILOTS OVHD PNL	34-22-02
COUPLER – COMPASS	2	FESC, REAR RACK/112AB	34-22-03
GYRO – DIRECTIONAL	2	FESC, DG RACK/112AB	34-22-04
INDICATOR – HORIZONTAL SITUATION	2	FLT STA, CAPT AND F/O INSTR. PNL	34-55-04
INDICATOR – RADIO DIGITAL DISTANCE MAGNETIC (RDDMI)	2	FLT STA, CAPT AND F/O INSTR. PNL	34-57-03
ACCESSORY UNIT – HEADING COUPLER	1	FESC, REAR RACK/112AB	34-22-06
VALVE – FLUX	2	L AND R WING TIP	34-22-05

M1-0000-34-3371

R Component Location Index
R Figure 101

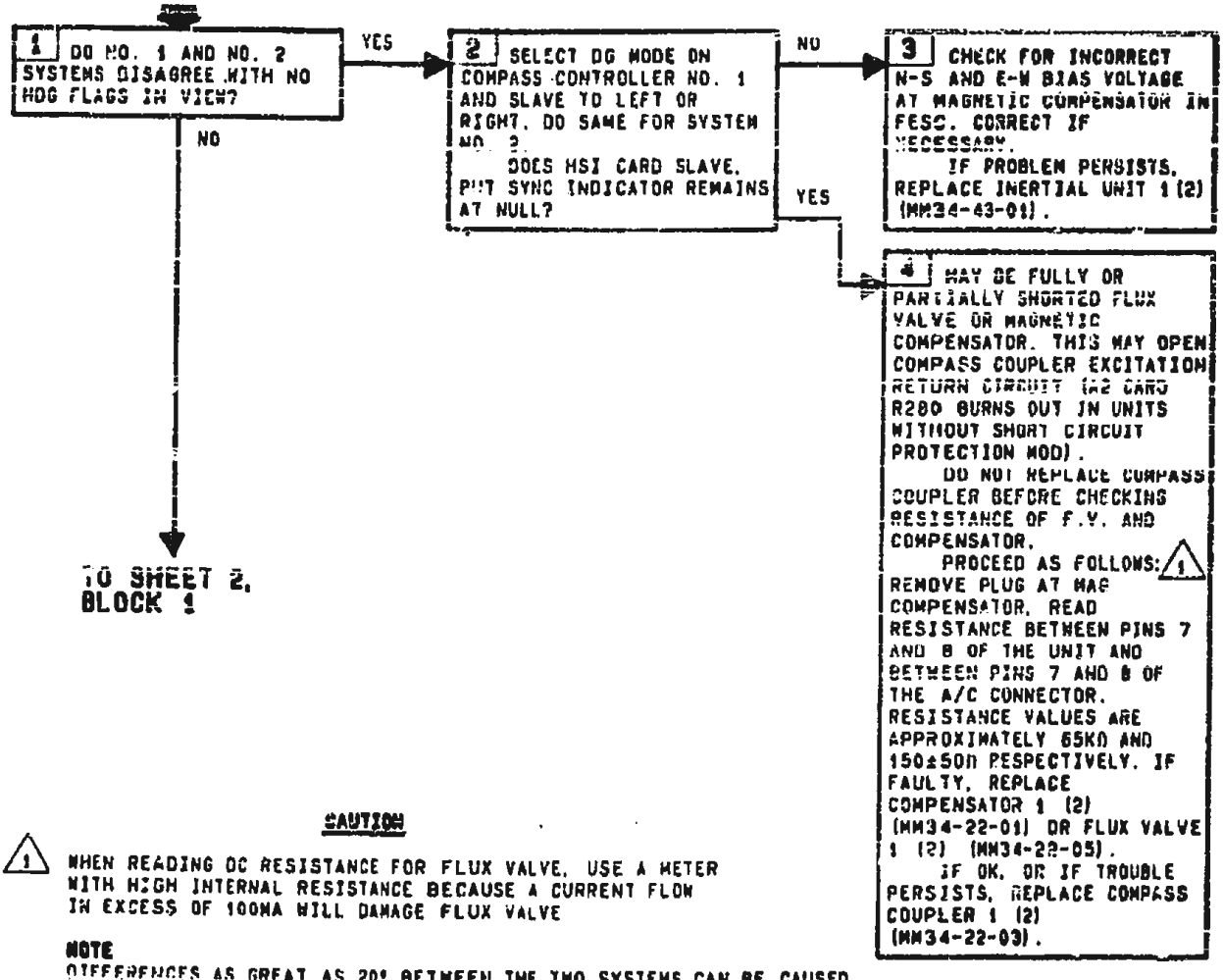
R EFFECTIVITY: ALL
R
001B



Component Locator Diagram
Figure 102

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S IN: SYS 1: 1D27, 1E1, (2) 1E6, (3) 1E7, 1E20, 1F3, 1F5, (5) 1G8, 1G7, 1J20, 1K19, 1K24
SYS 2: 1D9, 1E2, 1E3, 1F21, (3), 1G23, (2) 1G24, (5) 1G25, 1G26, 1J19, 1K20, 2A21, 2C19, 2C21
MAG SELECTED ON COMPASS CONTROLLER
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS RELEASED
INERTIALS SET TO ATT MODE, IF INSTALLED
TO PREVENT BATTERY DISCHARGE, TURN INERTIALS OFF AT TEST COMPLETION

HEADING SYSTEM FAULTS


1 DO NO. 1 AND NO. 2 SYSTEMS DISAGREE WITH NO HDG FLAGS IN VIEW?
YES
NO
2 SELECT DG MODE ON COMPASS CONTROLLER NO. 1 AND SLAVE TO LEFT OR RIGHT. DO SAME FOR SYSTEM NO. 2.
DOES HSI CARD SLAVE, BUT SYNC INDICATOR REMAINS AT NULL?
NO
YES
3 CHECK FOR INCORRECT N-S AND E-W BIAS VOLTAGE AT MAGNETIC COMPENSATOR IN FESC. CORRECT IF NECESSARY.
IF PROBLEM PERSISTS, REPLACE INERTIAL UNIT 1 (2) (MM34-43-01).
4 MAY BE FULLY OR PARTIALLY SHORTED FLUX VALVE OR MAGNETIC COMPENSATOR. THIS MAY OPEN COMPASS COUPLER EXCITATION RETURN CIRCUIT (A2 CARD R280 BURNS OUT IN UNITS WITHOUT SHORT CIRCUIT PROTECTION MOD).
DO NOT REPLACE COMPASS COUPLER BEFORE CHECKING RESISTANCE OF F.V. AND COMPENSATOR.
PROCEED AS FOLLOWS: (1)
REMOVE PLUG AT MAG COMPENSATOR. READ RESISTANCE BETWEEN PINS 7 AND 8 OF THE UNIT AND BETWEEN PINS 7 AND 8 OF THE A/C CONNECTOR. RESISTANCE VALUES ARE APPROXIMATELY 65KΩ AND 150±50Ω RESPECTIVELY. IF FAULTY, REPLACE COMPENSATOR 1 (2) (MM34-22-01) OR FLUX VALVE 1 (2) (MM34-22-05).
IF OK, OR IF TROUBLE PERSISTS, REPLACE COMPASS COUPLER 1 (2) (MM34-22-03).
TO SHEET 2, BLOCK 1

CAUTION

(1) WHEN READING DC RESISTANCE FOR FLUX VALVE, USE A METER WITH HIGH INTERNAL RESISTANCE BECAUSE A CURRENT FLOW IN EXCESS OF 100MA WILL DAMAGE FLUX VALVE

NOTE
DIFFERENCES AS GREAT AS 20° BETWEEN THE TWO SYSTEMS CAN BE CAUSED BY LOCAL MAGNETIC DISTURBANCES SUCH AS RAMPS, JETWAYS, TRUCKS, ETC. IF SUCH DISTURBANCES ARE IN THE VICINITY OF THE FLUX VALVE LOCATION, DISREGARD HEADING DIFFERENCES BETWEEN SYSTEMS IF THE SYSTEMS SYNCHRONIZE. SYNCHRONIZATION INDICATES THAT THE SYSTEMS ARE PROBABLY OPERATING PROPERLY.

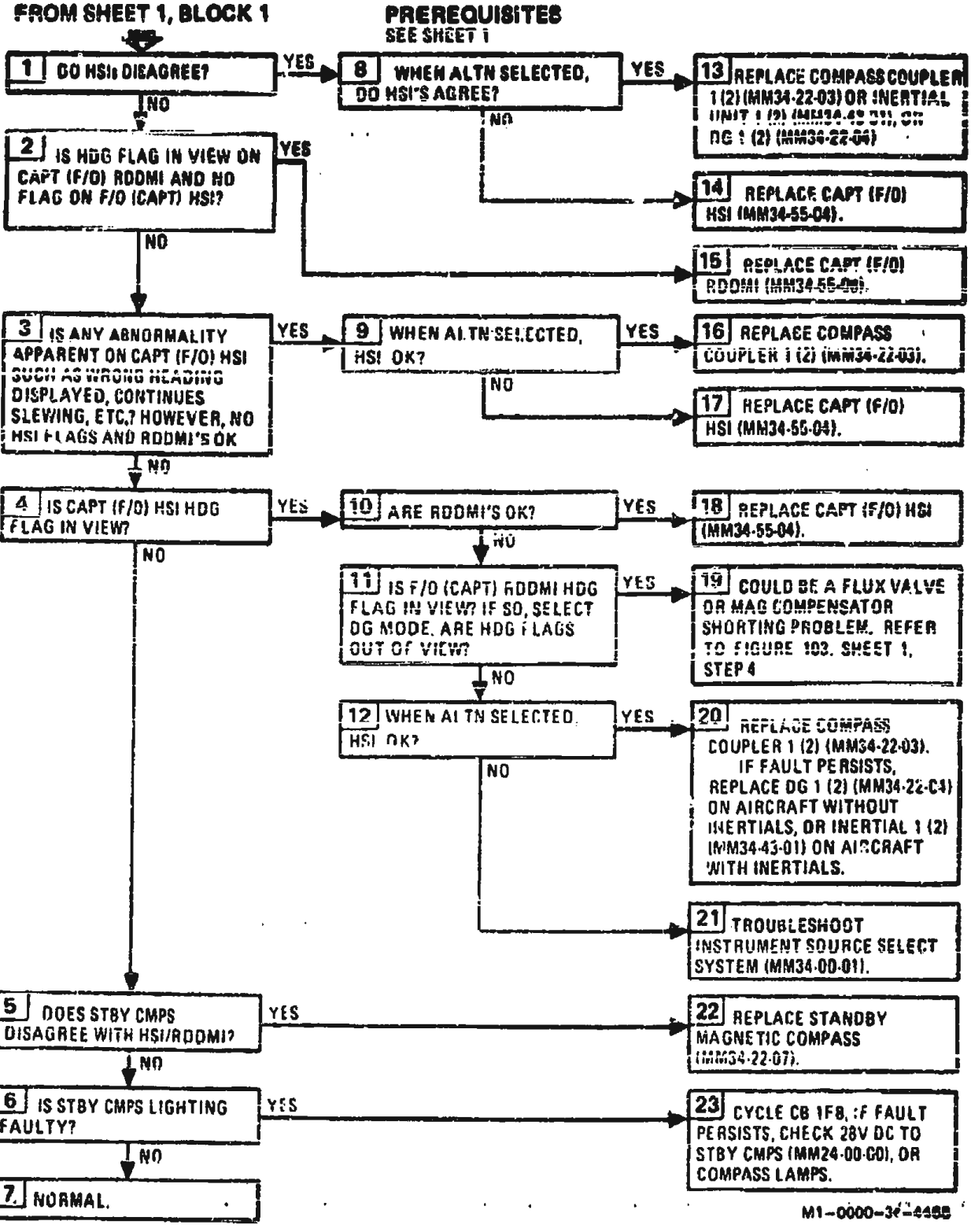
(2) AIRCRAFT WITH INERTIALS.

(3) AIRCRAFT WITHOUT INERTIALS.

A1-0008-34-1128

R
R

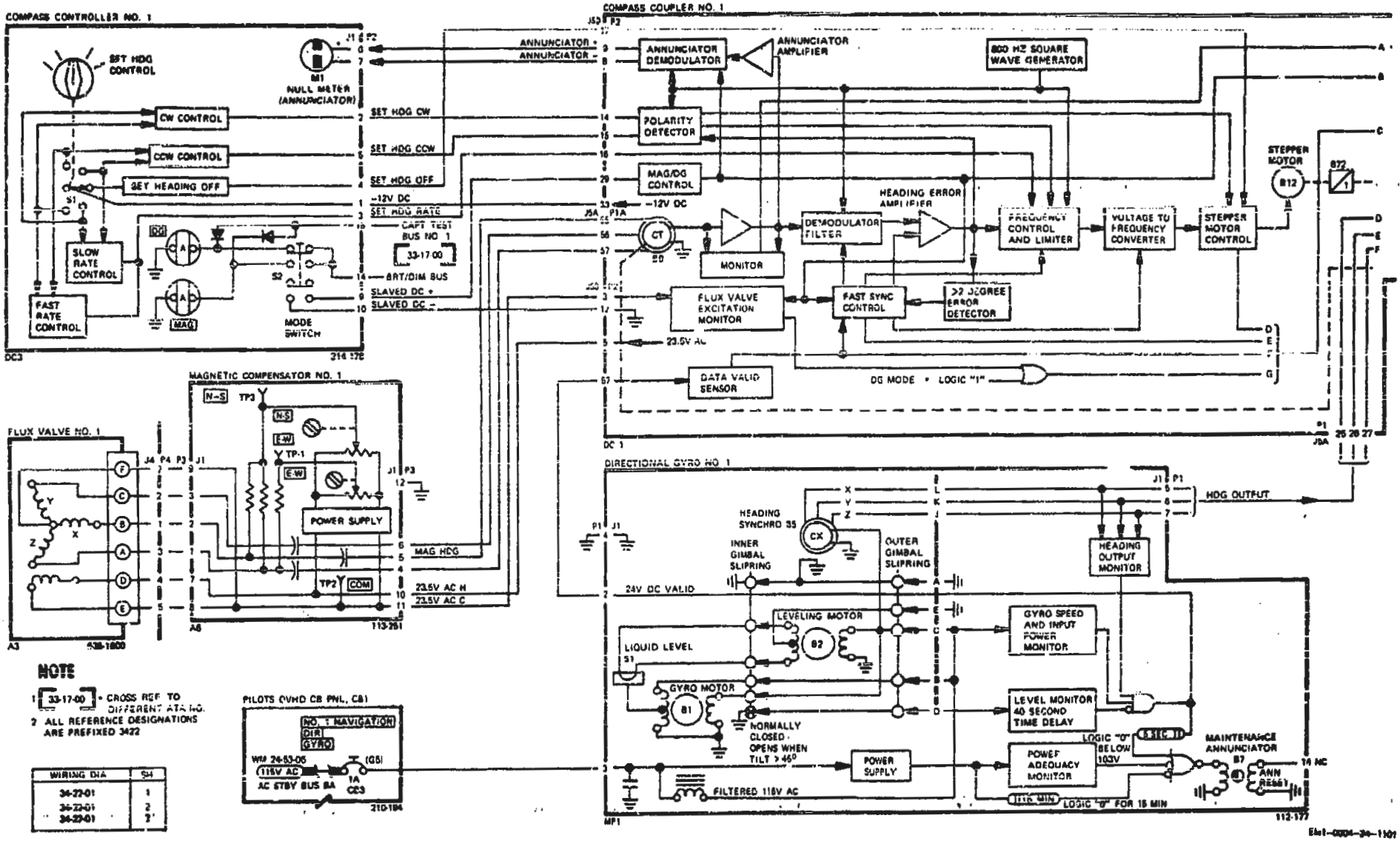
Heading System Faults
Figure 103 (Sheet 1)


FROM SHEET 1, BLOCK 1
PREREQUISITES
SEE SHEET 1
1 DO HSIs DISAGREE?
YES
NO
8 WHEN ALTN SELECTED, DO HSI'S AGREE?
YES
NO
13 REPLACE COMPASS COUPLER 1 (2) (MM34-22-03) OR INERTIAL UNIT 1 (2) (MM34-43-01), OR DG 1 (2) (MM34-22-04)
2 IS HDG FLAG IN VIEW ON CAPT (F/O) RDDMI AND NO FLAG ON F/O (CAPT) HSI?
YES
NO
14 REPLACE CAPT (F/O) HSI (MM34-55-04).
15 REPLACE CAPT (F/O) RDDMI (MM34-55-08).
3 IS ANY ABNORMALITY APPARENT ON CAPT (F/O) HSI SUCH AS WRONG HEADING DISPLAYED, CONTINUES SLEWING, ETC.? HOWEVER, NO HSI FLAGS AND RDDMI'S OK
YES
NO
9 WHEN ALTN SELECTED, HSI OK?
YES
NO
16 REPLACE COMPASS COUPLER 1 (2) (MM34-22-03).
17 REPLACE CAPT (F/O) HSI (MM34-55-04).
4 IS CAPT (F/O) HSI HDG FLAG IN VIEW?
YES
NO
10 ARE RDDMI'S OK?
YES
NO
18 REPLACE CAPT (F/O) HSI (MM34-55-04).
11 IS F/O (CAPT) RDDMI HDG FLAG IN VIEW? IF SO, SELECT DG MODE. ARE HDG FLAGS OUT OF VIEW?
YES
NO
19 COULD BE A FLUX VALVE OR MAG COMPENSATOR SHORTING PROBLEM. REFER TO FIGURE 103, SHEET 1, STEP 4
12 WHEN ALTN SELECTED, HSI OK?
YES
NO
20 REPLACE COMPASS COUPLER 1 (2) (MM34-22-03). IF FAULT PERSISTS, REPLACE DG 1 (2) (MM34-22-04) ON AIRCRAFT WITHOUT INERTIALS, OR INERTIAL 1 (2) (MM34-43-01) ON AIRCRAFT WITH INERTIALS.
21 TROUBLESHOOT INSTRUMENT SOURCE SELECT SYSTEM (MM34-00-01).
5 DOES STBY CMPS DISAGREE WITH HSI/RDDMI?
YES
NO
22 REPLACE STANDBY MAGNETIC COMPASS (MM34-22-07).
6 IS STBY CMPS LIGHTING FAULTY?
YES
NO
23 CYCLE CB 1F8, IF FAULT PERSISTS, CHECK 28V DC TO STBY CMPS (MM24-00-00), OR COMPASS LAMPS.
7 NORMAL.
M1-0000-34-4488

R Heading System Faults
R Figure 103 (Sheet 2)

EFFECTIVITY: ALL

001B

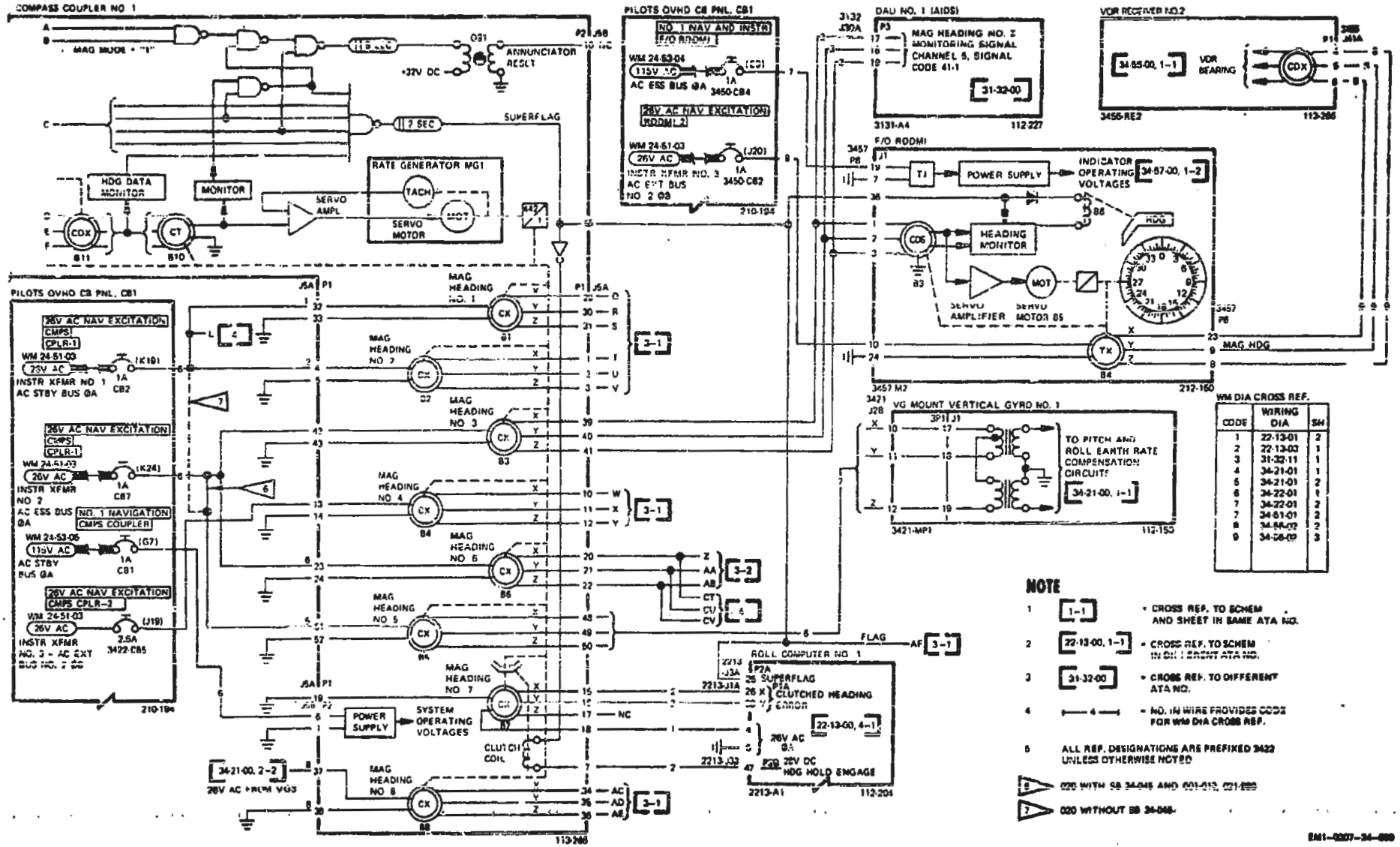


MHRS No. 1 Schematic
SCHEM 1 (Sheet 1)

CR
CR

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

001B

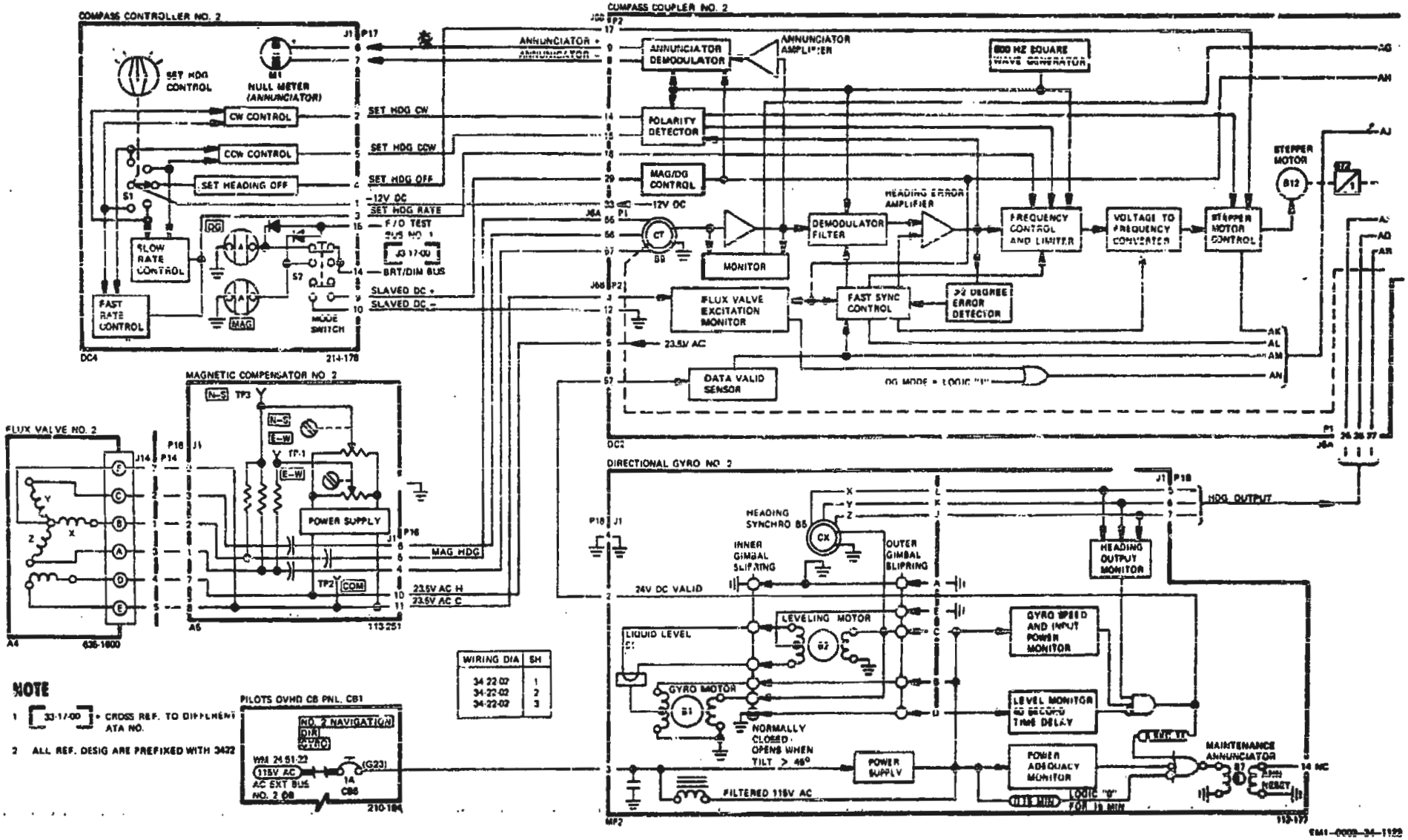


CR
CR

MHRS No. 1 Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

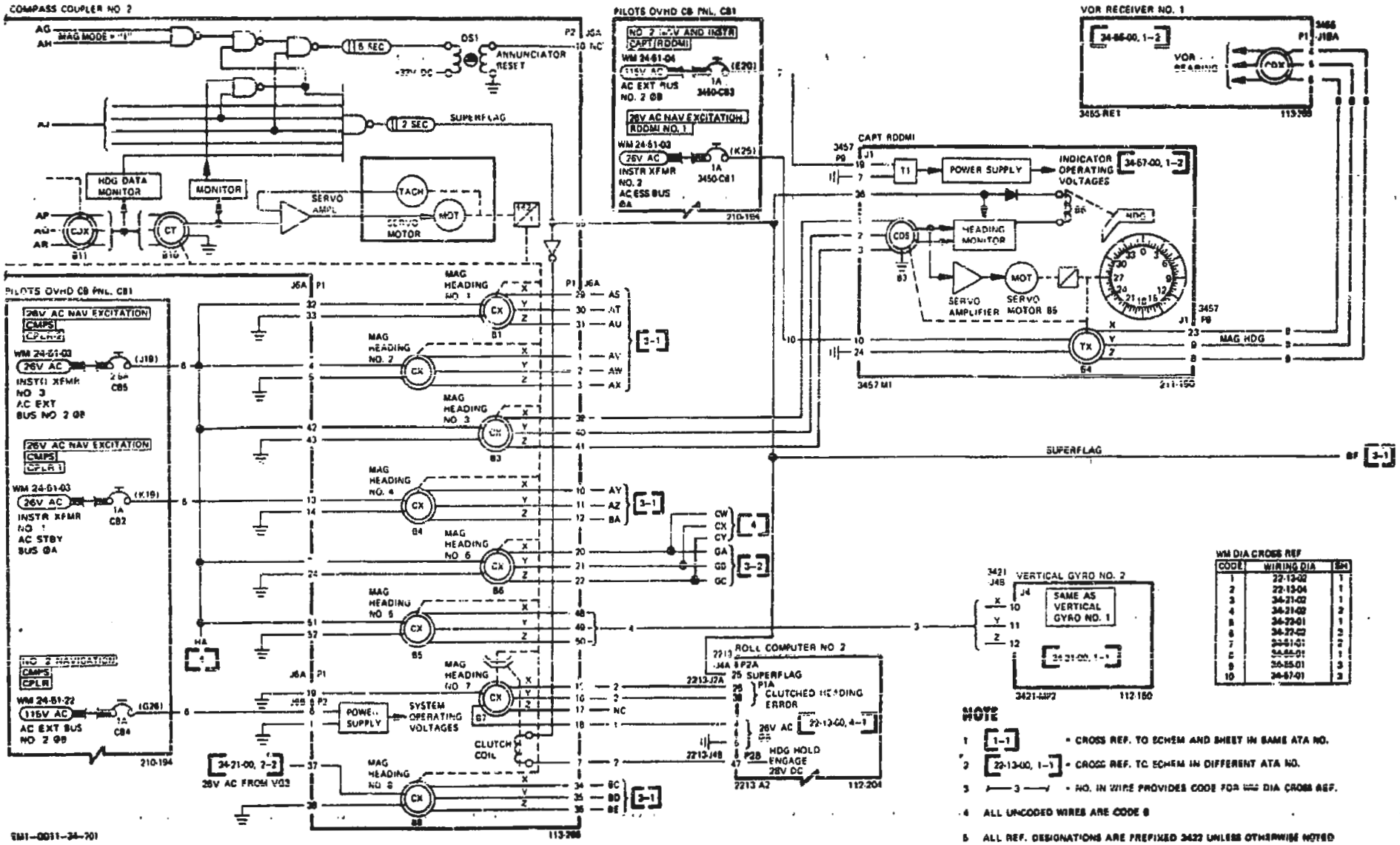
0018



CR MHRS No. 2 Schematic
CR SCHEM 2 (Sheet 1)

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

0018

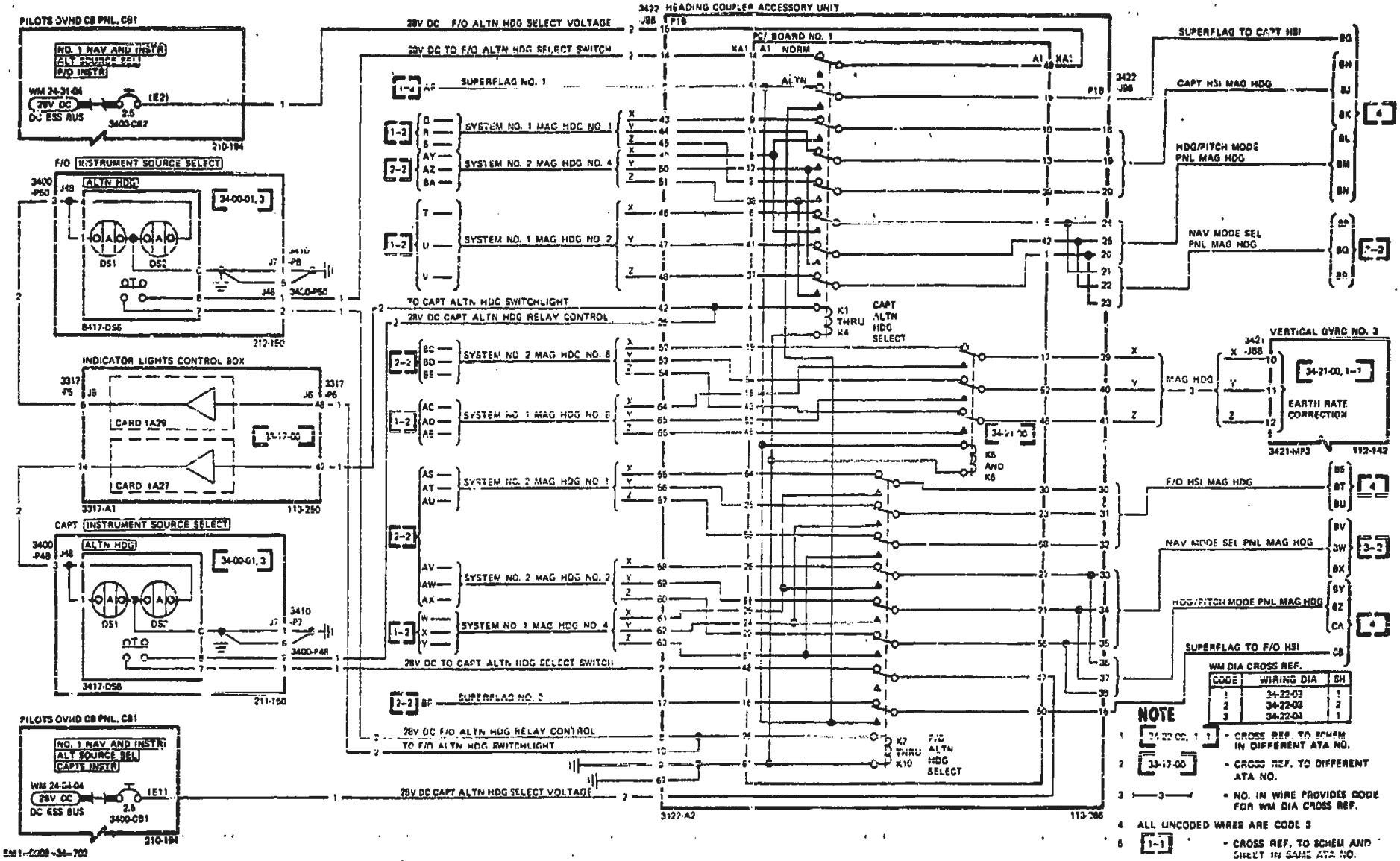

COMPASS COUPLER NO 2
PILOTS OVHD CB PNL, CB1
VOR RECEIVER NO. 1
CAPT RDDMI
POWER SUPPLY
INDICATOR OPERATING VOLTAGES
HEADING MONITOR
SERVO AMPLIFIER
SERVO MOTOR B5
MAG HDG
SUPERFLAG
MAG HEADING NO. 1
MAG HEADING NO. 2
MAG HEADING NO. 3
MAG HEADING NO. 4
MAG HEADING NO. 6
MAG HEADING NO. 5
MAG HEADING NO. 7
MAG HEADING NO. 8
ROLL COMPUTER NO 2
CLUTCHED HEADING ERROR
HDG HOLD ENGAGE
VERTICAL GYRO NO. 2
SAME AS VERTICAL GYRO NO. 1
ANNUNCIATOR RESET
SYSTEM OPERATING VOLTAGES
26V AC NAV EXCITATION CMPS CPLR-2
26V AC NAV EXCITATION CMPS CPLR 1
NO 2 NAVIGATION CMPS CPLR
26V AC FROM V03
WM DIA CROSS REF
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-13-00, 1-1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 —3— • NO. IN WIRE PROVIDES CODE FOR WIRE DIA CROSS REF.
4 ALL UNCODED WIRES ARE CODE 8
5 ALL REF. DESIGNATIONS ARE PREFIXED 3422 UNLESS OTHERWISE NOTED

MHRS No. 2 Schematic
SCHEM 2 (Sheet 2)

CR
CR

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

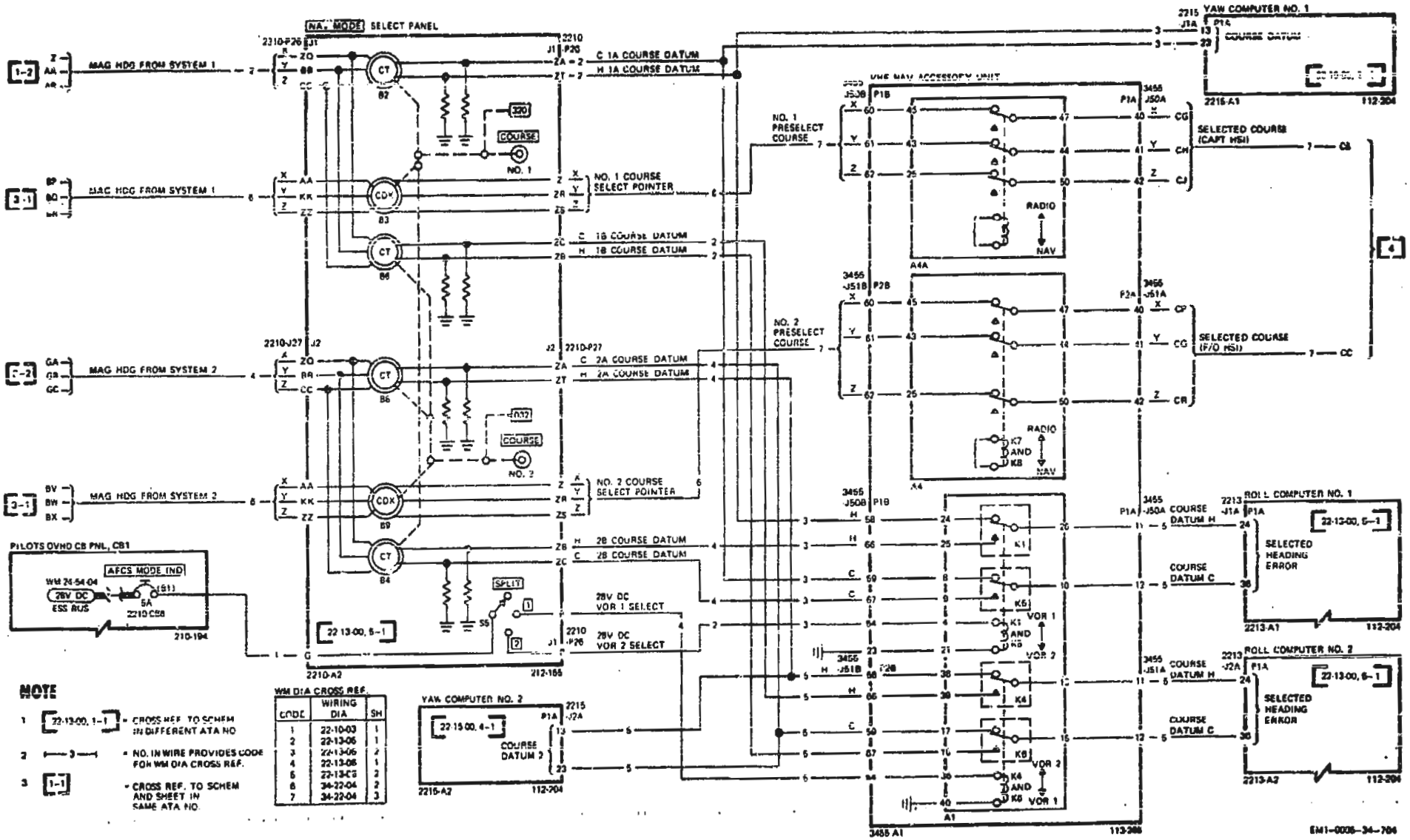
0018

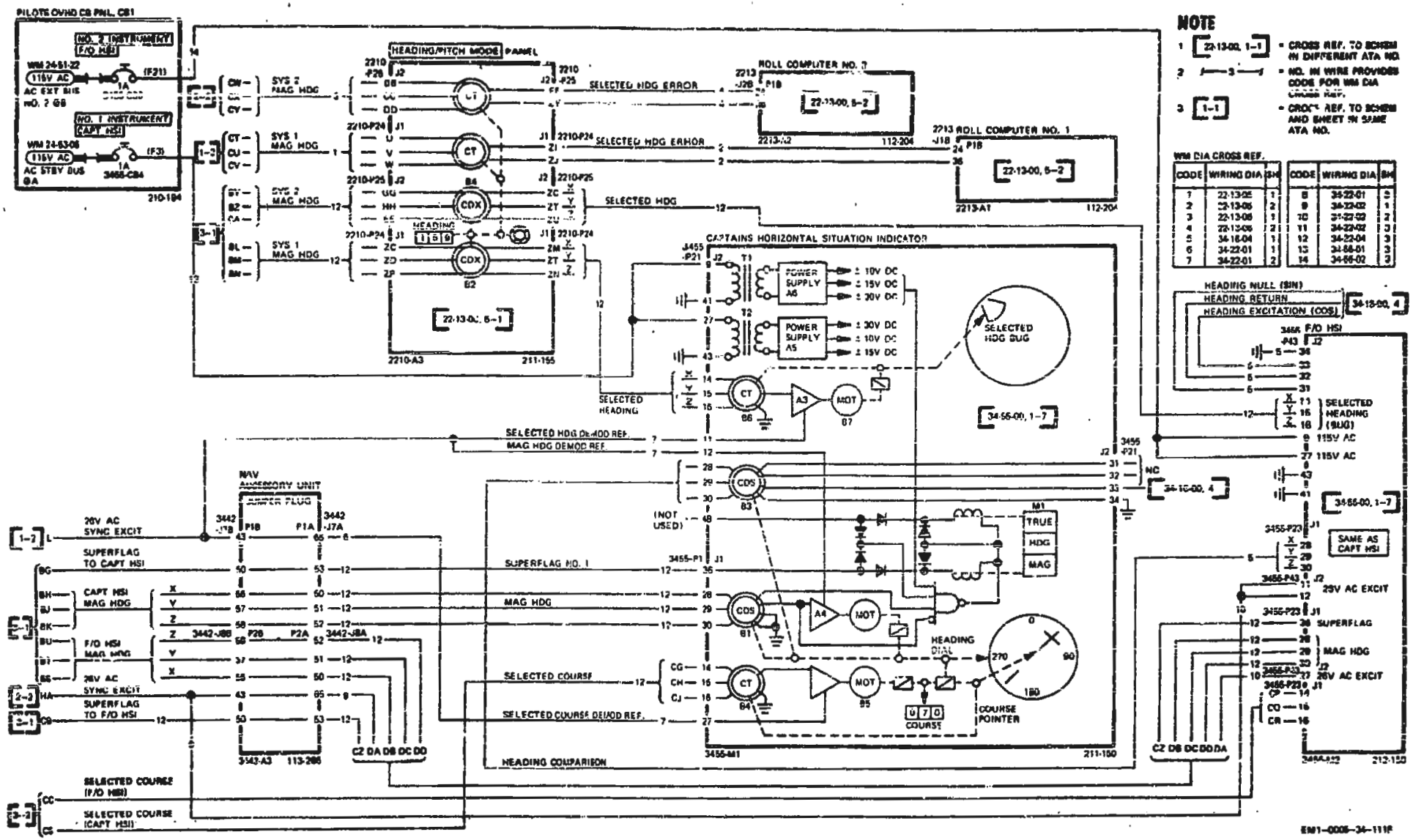

3422 HEADING COUPLER ACCESSORY UNIT
PC BOARD NO. 1
PILOTS OVHD CB PNL, CB1
NO. 1 NAV AND INSTR
ALT SOURCE SEL
F/O INSTR
28V DC
DC ESS BUS
F/O INSTRUMENT SOURCE SELECT
ALTN HDG
CAPT INSTRUMENT SOURCE SELECT
INDICATOR LIGHTS CONTROL BOX
CARD 1A29
CARD 1A27
CAPT NAV AND INSTR
ALT SOURCE SEL
CAPT INSTR
28V DC F/O ALTN HDG SELECT VOLTAGE
28V DC TO F/O ALTN HDG SELECT SWITCH
SUPERFLAG NO. 1
SYSTEM NO. 1 MAG HDG NO. 1
SYSTEM NO. 2 MAG HDG NO. 4
SYSTEM NO. 1 MAG HDG NO. 2
TO CAPT ALTN HDG SWITCHLIGHT
28V DC CAPT ALTN HDG RELAY CONTROL
SYSTEM NO. 2 MAG HDG NO. 6
SYSTEM NO. 1 MAG HDG NO. 6
SYSTEM NO. 2 MAG HDG NO. 1
SYSTEM NO. 2 MAG HDG NO. 2
SYSTEM NO. 1 MAG HDG NO. 4
28V DC TO CAPT ALTN HDG SELECT SWITCH
28V DC F/O ALTN HDG RELAY CONTROL
TO F/O ALTN HDG SWITCHLIGHT
28V DC CAPT ALTN HDG SELECT VOLTAGE
CAPT ALTN HDG SELECT
F/O ALTN HDG SELECT
SUPERFLAG TO CAPT HSI
CAPT HSI MAG HDG
HDG/PITCH MODE PNL MAG HDG
NAV MODE SEL PNL MAG HDG
VERTICAL GYRO NO. 3
EARTH RATE CORRECTION
F/O HSI MAG HDG
NAV MODE SEL PNL MAG HDG
HDG/PITCH MODE PNL MAG HDG
SUPERFLAG TO F/O HSI
WM DIA CROSS REF.
NOTE
1 - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2 - CROSS REF. TO DIFFERENT ATA NO.
3 - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 ALL UNCODED WIRES ARE CODE 3
5 - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

CR MHRS Schematic
CR (ALTN Switching)
CR SCHEM 3 (Sheet 1)

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

001B

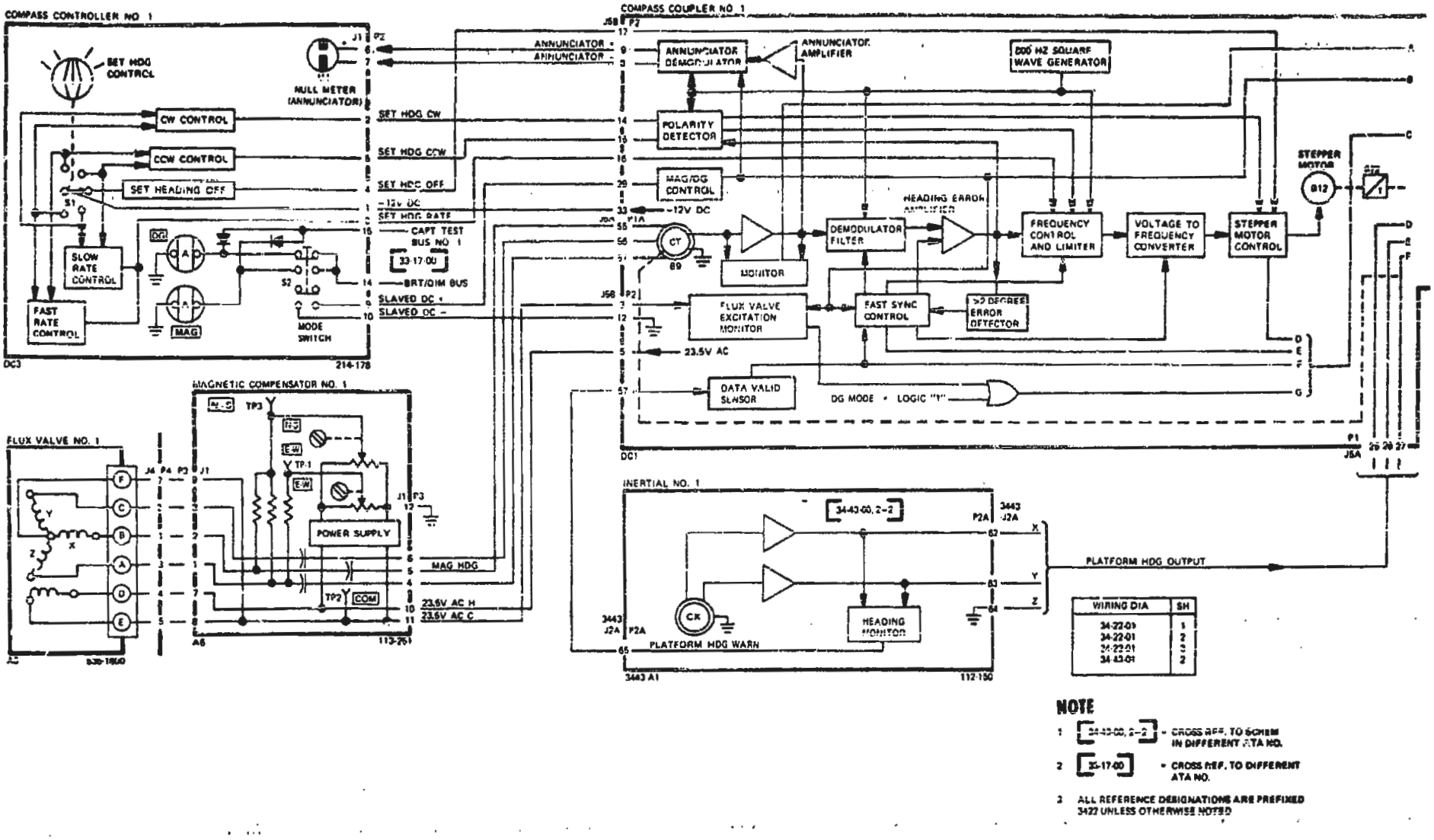

NAV MODE SELECT PANEL
2210-P26 J1
2210 J1 P26
MAG HDG FROM SYSTEM 1
C 1A COURSE DATUM
H 1A COURSE DATUM
320
COURSE
NO. 1
NO. 1 COURSE SELECT POINTER
MAG HDG FROM SYSTEM 1
C 1B COURSE DATUM
H 1B COURSE DATUM
2210-J27 J2
2210-P27 J2
MAG HDG FROM SYSTEM 2
C 2A COURSE DATUM
H 2A COURSE DATUM
COURSE
NO. 2
NO. 2 COURSE SELECT POINTER
MAG HDG FROM SYSTEM 2
C 2B COURSE DATUM
H 2B COURSE DATUM
SPLIT
28V DC VOR 1 SELECT
28V DC VOR 2 SELECT
PILOTS OVHD CB PNL, CB1
AFCS MODE IND
WM 24-54-04
28V DC ESS BUS
5A
2210-C58
22-13-00, 6-1
2210-A2
212-165
NOTE
1 22-13-00, 1-1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO
2 —3— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
3 1-1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-10-03 | 1
2 | 22-13-05 | 1
3 | 22-13-06 | 2
4 | 22-13-08 | 1
5 | 22-13-09 | 2
6 | 34-22-04 | 2
7 | 34-22-04 | 3
YAW COMPUTER NO. 2
22-13-00, 4-1
P1A J2A
COURSE DATUM 2
2215-A2
112-204
2215 YAW COMPUTER NO. 1
J1A P1A
COURSE DATUM
2215-A1
112-204
VHF NAV ACCESSORY UNIT
3455 J50B P1B
3455 J50A P1A
NO. 1 PRESELECT COURSE
SELECTED COURSE (CAPT HSI)
RADIO
NAV
A4A
3455 J51B P2B
3455 J51A P2A
NO. 2 PRESELECT COURSE
SELECTED COURSE (F/O HSI)
K7 AND K8
A4
3455 J50B P1B
3455 J50A P1A
COURSE DATUM H
COURSE DATUM C
K1
K5
K2 AND K6
VOR 1
VOR 2
ROLL COMPUTER NO. 1
2213 J1A P1A
22-13-00, 6-1
SELECTED HEADING ERROR
2213-A1
112-204
3455 J51B P2B
3455 J51A P2A
K3
K4
K4 AND K8
ROLL COMPUTER NO. 2
2213 J2A P1A
2213-A2
3455 A1
113-388
EM1-0005-34-704



CR MHRS Schematic (HSIs)
CR SCHEM 4

EFFECTIVITY: VG/DG EQUIPPED AIRCRAFT

001B



WIRING DIA	SH
34-22-01	1
34-22-01	2
34-22-01	3
34-43-01	2

NOTE

1. [34-43-00, 2-2] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. [33-17-00] = CROSS REF. TO DIFFERENT ATA NO.
3. ALL REFERENCE DESIGNATIONS ARE PREFIXED 3422 UNLESS OTHERWISE NOTED

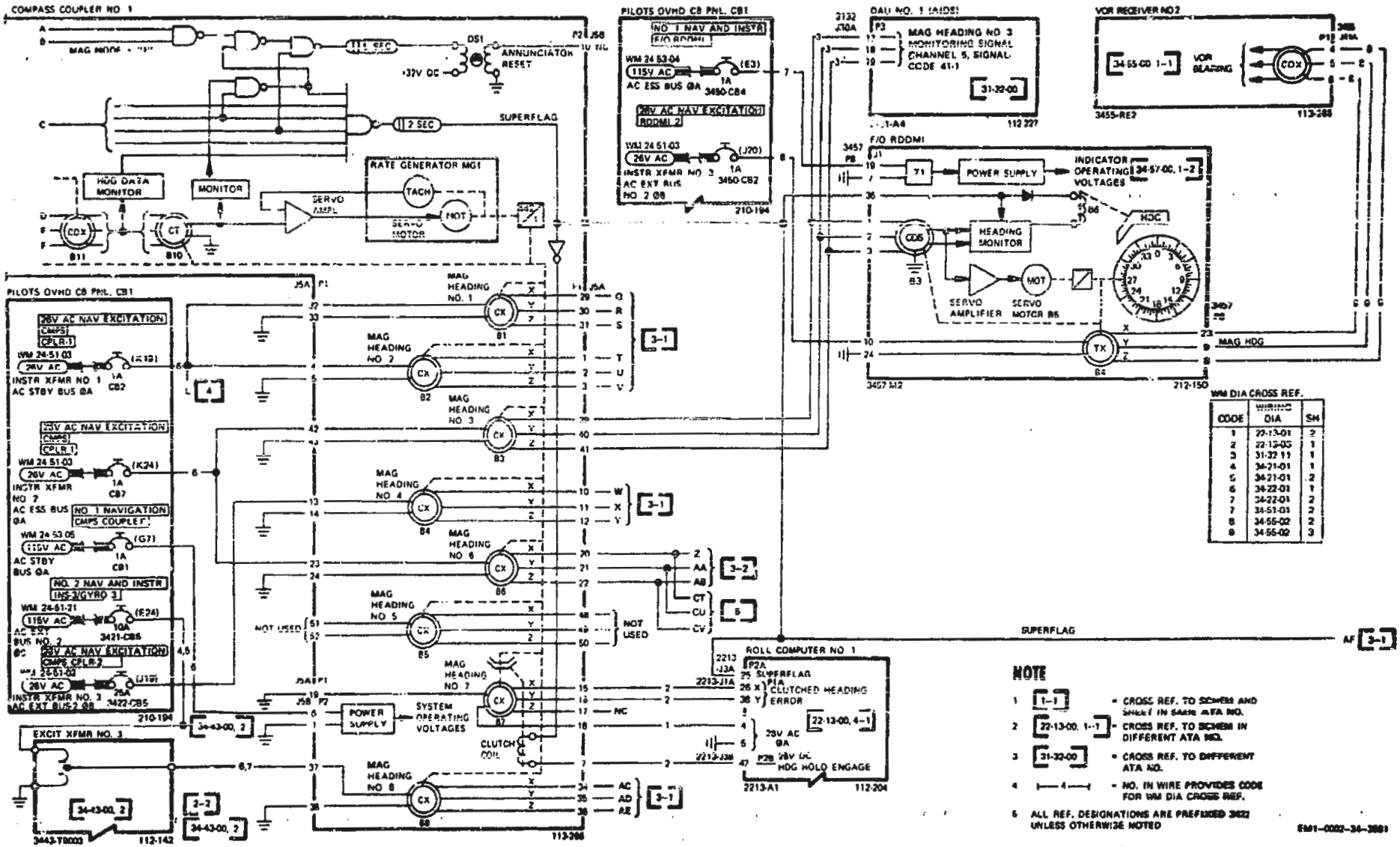
EM1-0002-34-S22

CR
CR

MHRS No. 1 Schematic
SCHEM 1 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

001B

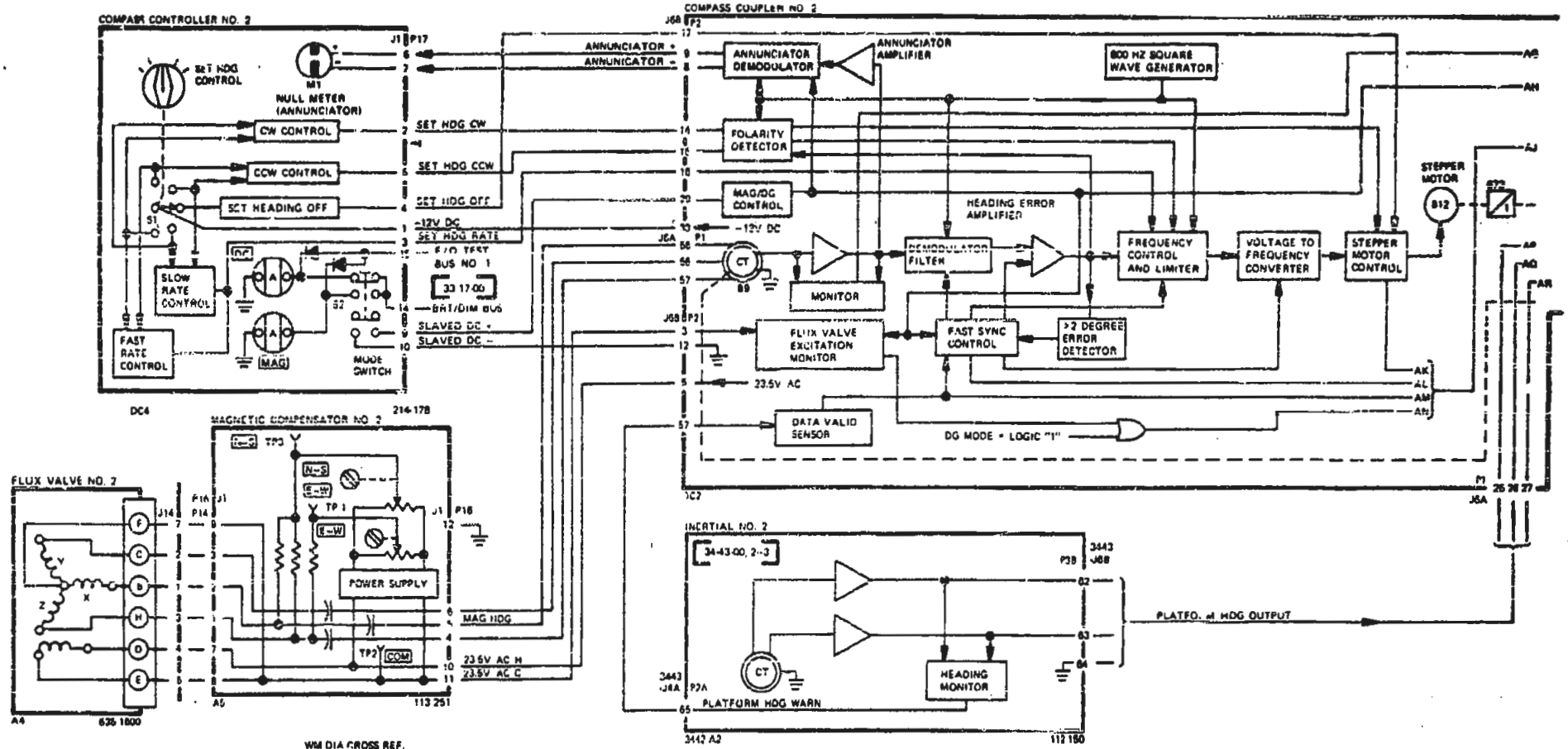


MHRS No. 1 Schematic
SCHEM 1 (Sheet 2)

CR
CR

EFFECTIVITY: INS EQUIPPED AIRCRAFT

001B



WM DIA CROSS REF.	
WIRING DIA	SH
34-22-02	1
34-22-02	2
34-22-02	3
34-43-07	2

NOTE

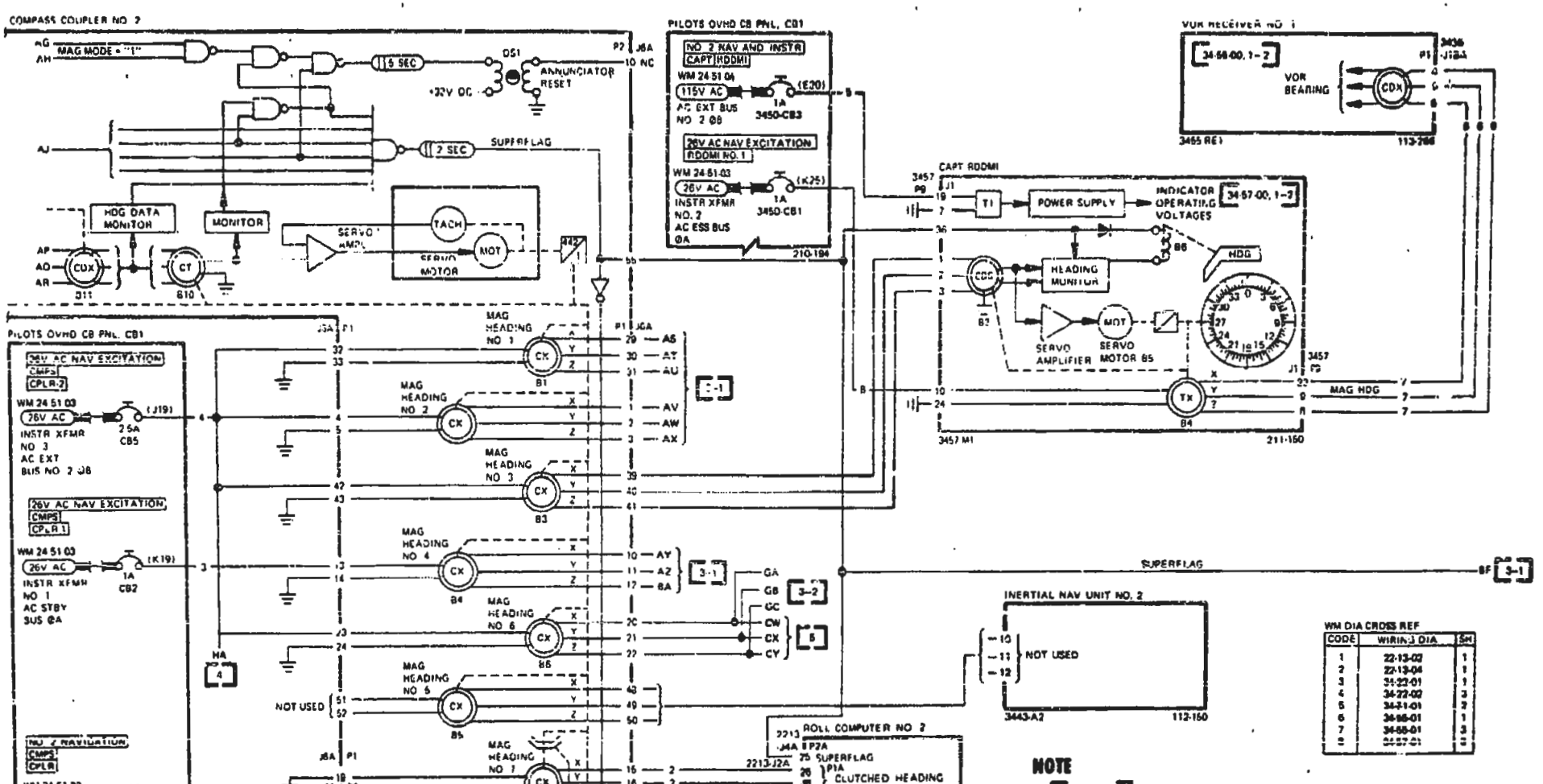
1. [34-43-00, 2-3] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. [33 17 00] - CROSS REF. TO DIFFERENT ATA NO.
3. ALL REF. DESIGNATIONS ARE PREFIXED WITH 3422 UNLESS OTHERWISE NOTED

EM1-0002-34-633

CR MHRS No. 2 Schematic
CR SCHEM 2 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

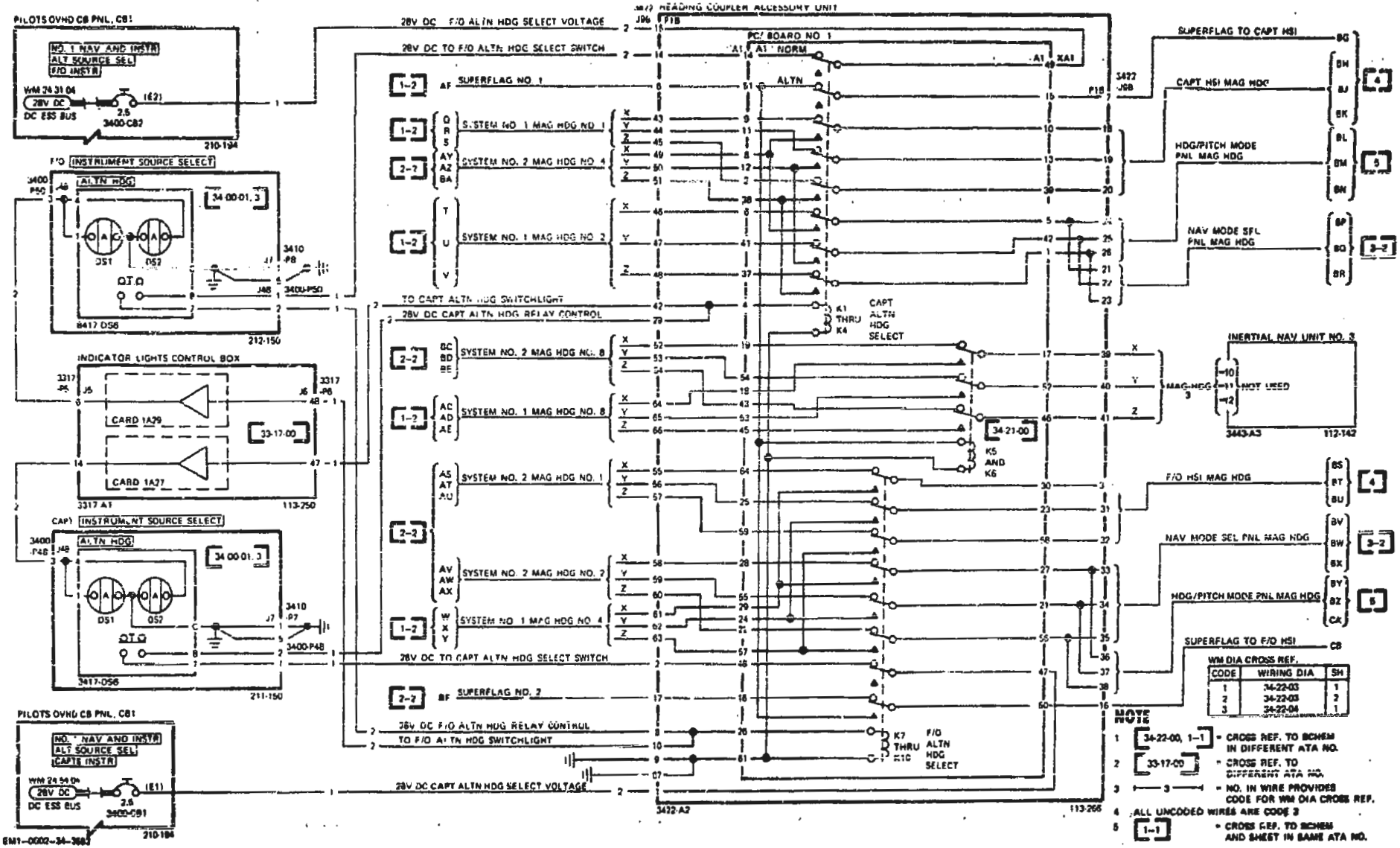
0010



CR No. 2 Schematic
CR SCHEM 2 (Sheet 2)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

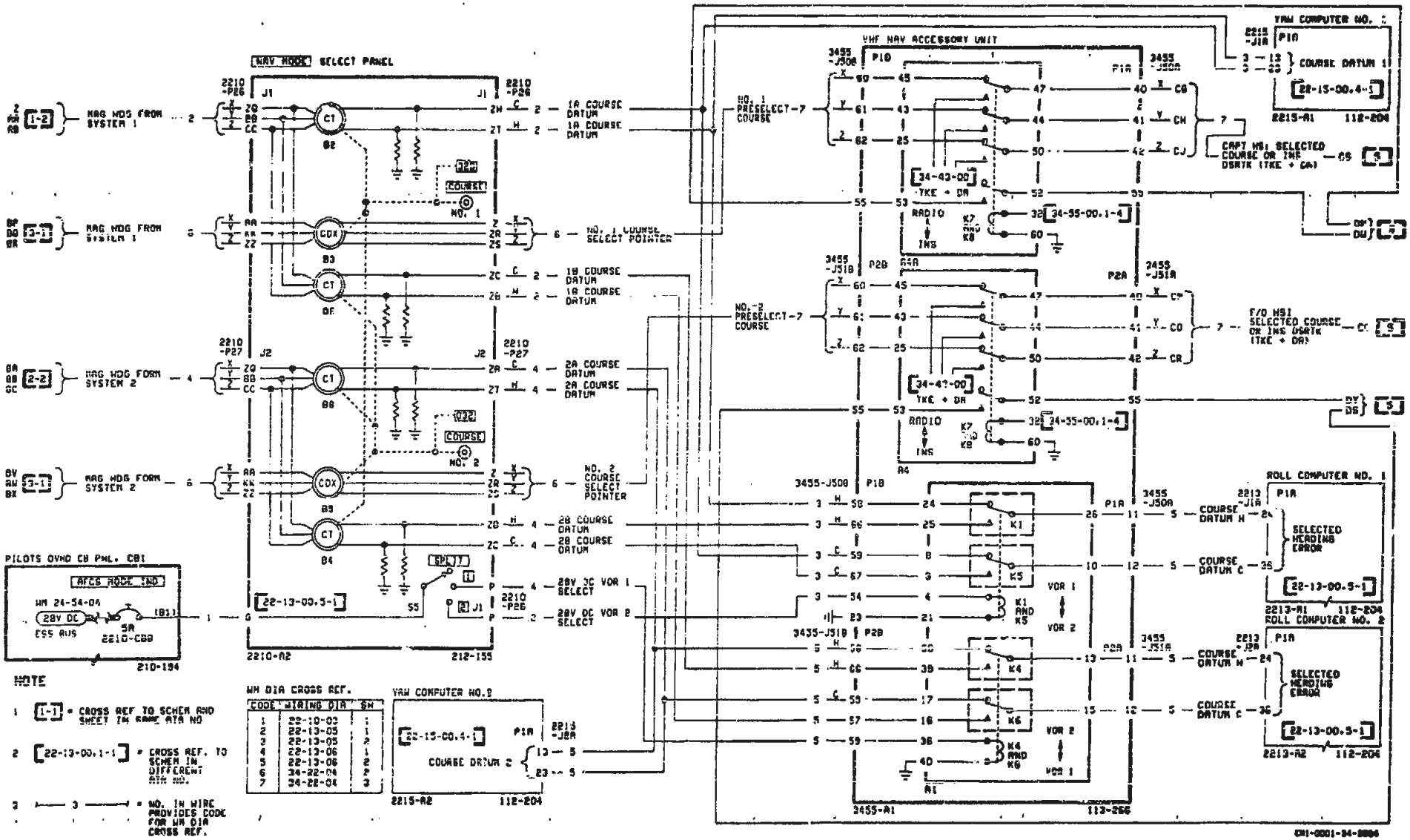
001B


PILOTS OVHD CB PNL, CB1
NO. 1 NAV AND INSTR
ALT SOURCE SEL
F/O INSTR
28V DC
DC ESS BUS
3400-CB2
210-194
F/O INSTRUMENT SOURCE SELECT
ALTN HDG
8417 DS6
212-150
INDICATOR LIGHTS CONTROL BOX
CARD 1A29
CARD 1A27
3317 A1
113-250
CAPT INSTRUMENT SOURCE SELECT
3417-DS6
211-150
PILOTS OVHD CB PNL, CB1
NO. 2 NAV AND INSTR
ALT SOURCE SEL
CAPT INSTR
28V DC
DC ESS BUS
3400-CB1
210-194
28V DC F/O ALTN HDG SELECT VOLTAGE
28V DC TO F/O ALTN HDG SELECT SWITCH
SUPERFLAG NO. 1
SYSTEM NO. 1 MAG HDG NO. 4
SYSTEM NO. 2 MAG HDG NO. 4
SYSTEM NO. 1 MAG HDG NO. 2
TO CAPT ALTN HDG SWITCHLIGHT
28V DC CAPT ALTN HDG RELAY CONTROL
SYSTEM NO. 2 MAG HDG NO. 8
SYSTEM NO. 1 MAG HDG NO. 8
SYSTEM NO. 2 MAG HDG NO. 1
SYSTEM NO. 2 MAG HDG NO. 2
SYSTEM NO. 1 MAG HDG NO. 4
28V DC TO CAPT ALTN HDG SELECT SWITCH
SUPERFLAG NO. 2
28V DC F/O ALTN HDG RELAY CONTROL
TO F/O ALTN HDG SWITCHLIGHT
28V DC CAPT ALTN HDG SELECT VOLTAGE
HEADING COUPLER ACCESSORY UNIT
PC BOARD NO. 1
NORM
ALTN
K1 THRU K4 CAPT ALTN HDG SELECT
K5 AND K6
K7 THRU K10 F/O ALTN HDG SELECT
3432-A2
113-266
SUPERFLAG TO CAPT HSI
CAPT HSI MAG HDG
HDG/PITCH MODE PNL MAG HDG
NAV MODE SEL PNL MAG HDG
INERTIAL NAV UNIT NO. 3
MAG HDG
NOT USED
3443-A3
112-142
F/O HSI MAG HDG
NAV MODE SEL PNL MAG HDG
HDG/PITCH MODE PNL MAG HDG
SUPERFLAG TO F/O HSI
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 34-22-03 | 1
2 | 34-22-03 | 2
3 | 34-22-04 | 1
NOTE
1 34-22-00, 1-1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2 33-17-00 = CROSS REF. TO DIFFERENT ATA NO.
3 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 ALL UNCODED WIRES ARE CODE 3
5 1-1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

CR MHRS Schematic
CR (ALTN Switching)
CR SCHEM 3 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

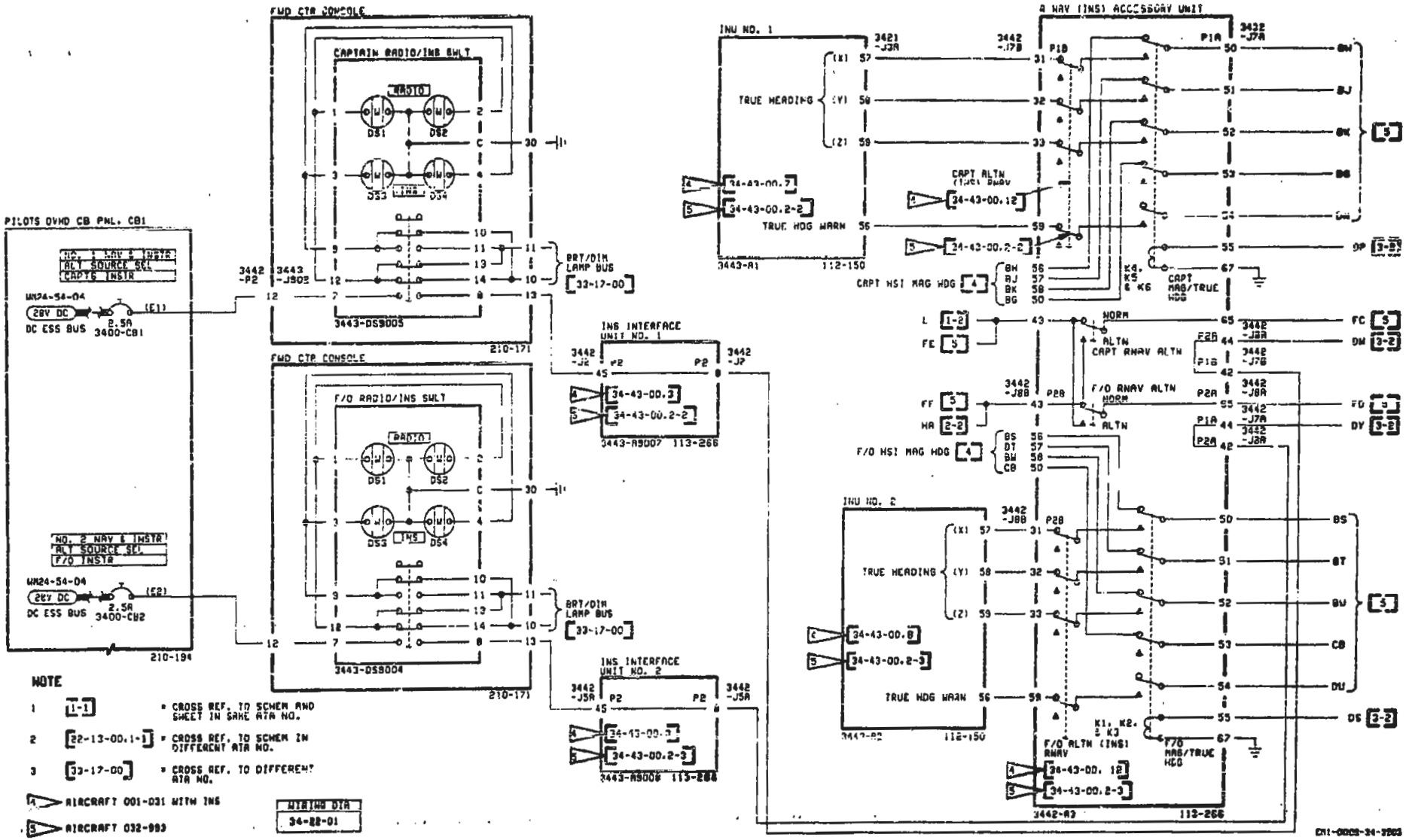
001B



MHRS Schematic
(Nav Mode Pnl - VHF Nav Access Unit)
SCHEM 3 (Sheet 2)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

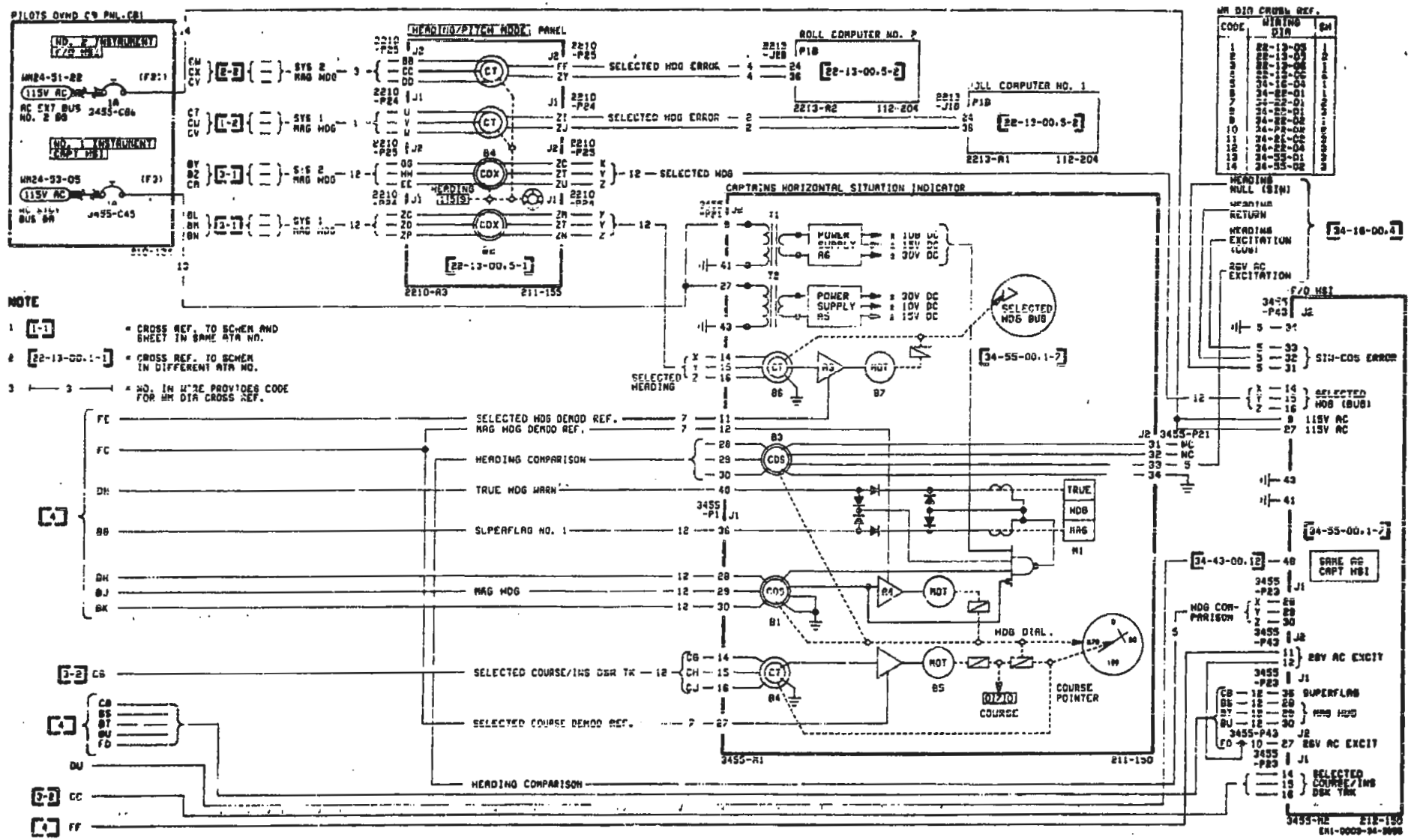
001B



CR MHR$ Schematic
CR (RADIO/INS SW-NAV Access Unit)
CR SCHEM 4

EFFECTIVITY: INS EQUIPPED AIRCRAFT

001B



MHRS Schematic
(HSI)
SCHEM 5

EFFECTIVITY: INS EQUIPPED AIRCRAFT

R MAGNETIC HEADING REFERENCE SYSTEM CALIBRATION - MAINTENANCE PRACTICE

R 1. General

R Magnetic heading reference system (No. 1 and No. 2) is calibrated (compensated) to minimize errors due to magnetic elements within the aircraft. This may be accomplished by physically positioning aircraft (swinging aircraft) to known magnetic headings or by electrically positioning aircraft to magnetic headings using the MC-2 compass calibrator. The aircrafts indicated heading is compared to the known heading (or heading set into the MC-2 compass calibrator) and the flux valves are then compensated as necessary. This procedure contains both processes.

R NOTE: Electrical swinging (MC-2) is the preferred method of swinging the compass system.

R The procedure also contains a separate standby compass calibration (swing/compensation) procedure. This procedure may be accomplished concurrently with No. 1 and No. 2 magnetic heading reference system mechanical compass swing.

R A. Electrical Compass Swing

R Electrical compass swinging is accomplished by generation of a magnetic field within the flux valve using the MC-2 compass calibrator. This field is produced by applying dc currents to the secondary coils of the flux valve. These coils are spaced 120-degrees apart on the legs of a magnetic core. Passing dc currents through the coils generates a magnetic field within the core. Controls on the MC-2 control console are used to adjust magnitude and direction of dc currents, rotating the magnetic field in the flux valve to various headings, simulating rotation of the aircraft and allowing measurement and compensation for magnetic reference system errors.

R B. Conventional Compass Swing

R Conventional compass swinging is accomplished by accurately aligning aircraft with a minimum of four cardinal headings and observing the deviation between the known heading and indicated heading. The results are tabulated and flux valves and standby compass are then compensated as necessary.

R C. Standby Compass Swing

Standby compass swinging is accomplished using a master magnetic compass and standby compass calibrator. The master magnetic compass is used to calibrate the standby compass calibrator to the calibration site and the standby compass calibrator is used to calibrate (compensate) standby compass. The standby compass calibrator contains field simulating magnets which are used to transmit headings to the standby compass. Indicated headings are compared against transmitted headings, and standby compass is then compensated as necessary.

CR NOTE: Air bubbles sometimes appear in the standby magnetic CR compass due to temperature changes and/or loss of CR liquid. Maintenance limits have been established for CR liquid quantity to assure satisfactory compass CR operation. When an air bubble exceeds 1/8 inch high CR and 3/8 inch wide, with the glass in approximate CR vertical position, the standby compass must be CR replaced.

2. Referenced Procedures

9-11-00	Normal Towing Conditions - Maintenance Practices
21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power System - Maintenance Practices
23-43-00	Service Interphone System - Maintenance Practices
34-22-00	Magnetic Heading Reference System - Adjustment and Test
34-43-00	Inertial System - Adjustment and test (aircraft with INERTIAL SYSTEMS)
34-22-05	Flux Valve - Removal and Installation

3. Calibration

A. Electrical Compass Swing

(1) Equipment Required

MC-2 Magnetic Compass Calibrator Set, Part No. 2592080-8, Sperry Flight Systems Division

Electronic Voltmeter (dc vtvm) - Model MV-17C, Millivac Instruments Inc., or equivalent

(2) Preparation

It is assumed that a surveyed swing site with an established north-south line has been prepared for L-1011 aircraft use, ie, No. 1 and No. 2 flux valve locations, monitor location and reference target location permanently marked at swing site.

NOTE: Verify that Flux Valve is a pre-indexed and calibrated unit.

(a) Tow aircraft into position at swing site with aircraft centerline over north-south line and wing tips over flux valve locator marks (Ref. 9-11-00) and nose pointing to north.

(b) Connect plumb line (2) at FS 539 and at FS 1453.

NOTE: Plumb line locations are on aircraft centerline and marked with stenciled circles 914-inches (76.2-feet) apart on all aircraft except -500. Dash 500 locations are at 814-inches (67.8-feet).

(c) Mark points where plumb bob comes to rest on ground.

(d) Measure and note lateral displacement of each plumb bob from edge of north-south line.

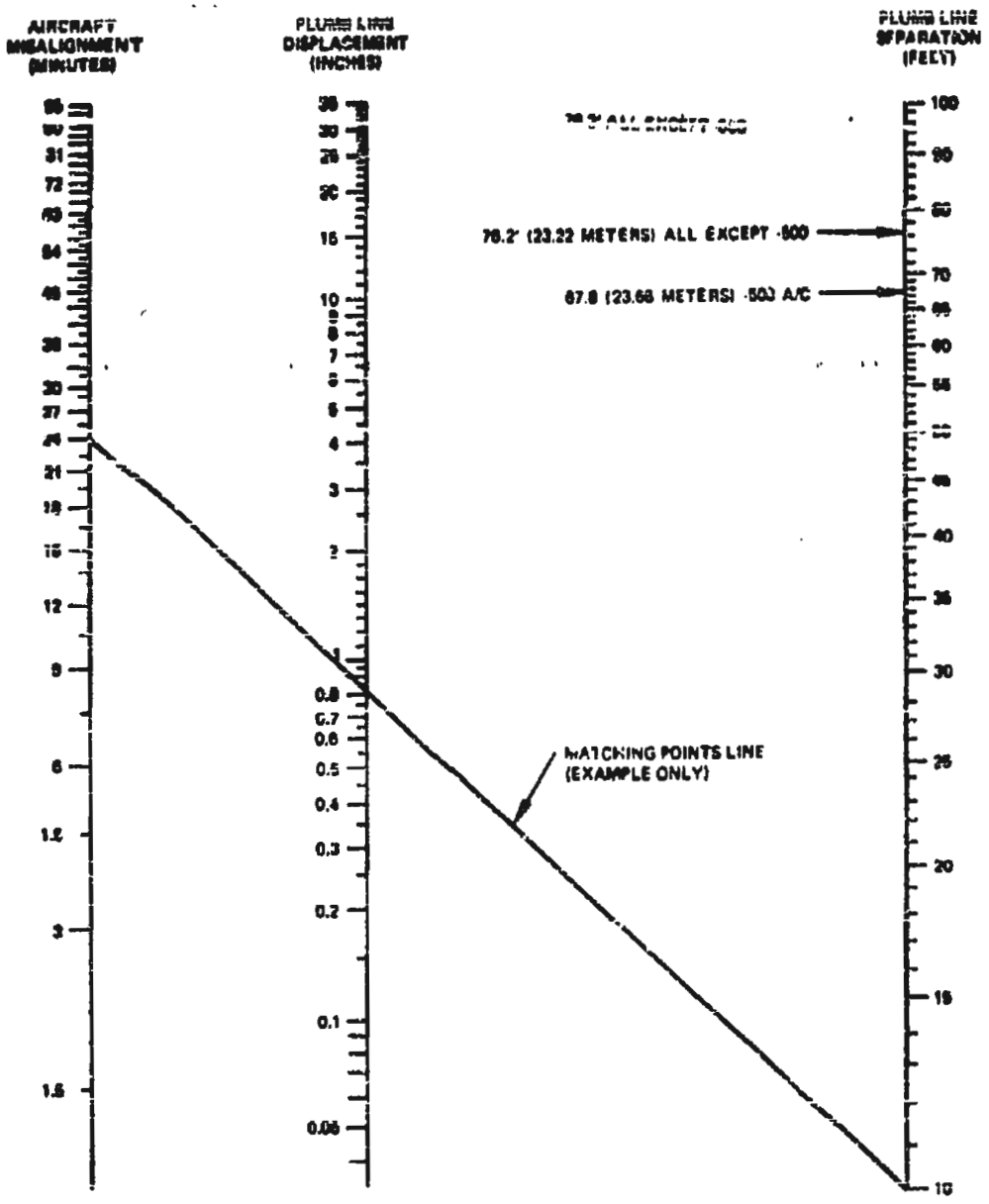
NOTE: If displacement is west of north-south line, it is negative; if it is east of north-south line, it is positive.

(e) Algebraically subtract lateral displacement of plumb bob at FS 1453 from lateral displacement of plumb bob at FS 539. Determine and note aircraft misalignment using nomograph (Ref. Fig. 201).

NOTE: If aircraft misalignment is greater than 60-minutes, reposition aircraft on north-south line to reduce misalignment to less than 60-minutes.

CAUTION: ENSURE AIRCRAFT ELECTRICAL POWER IS NOT TURNED ON.

(f) Open access door 112AB and enter forward electronic service center. Locate magnetic compensator No. 1 at FS 233, WL 194 BL. Remove aircraft connector P3 from connector J1 on rear of magnetic compensator No. 1. Connect cable with


AIRCRAFT MISALIGNMENT (MINUTES)
PLUMB LINE DISPLACEMENT (INCHES)
PLUMB LINE SEPARATION (FEET)
78.2' (23.22 METERS) ALL EXCEPT -600
67.8 (23.66 METERS) -500 A/C
MATCHING POINTS LINE (EXAMPLE ONLY)

NOTE

- EXAMPLE SHOWN WITH 4 INCH PLUMB BOB DISPLACEMENT FOR AN AIRCRAFT MISALIGNMENT OF 15 MINUTES
- AIRCRAFT MISALIGNMENT MUST BE LESS THAN 60 MINUTES

M1-0001-34-880

R R Aircraft Misalignment Nomograph
Figure 201

R EFFECTIVITY: ALL

002B

connector on MHRS adapter Part No. 2575831 (part of MC-2 compass calibrator) to connector J1 on magnetic compensator No. 1. Connect connector 3J1 on MHRS adapter to aircraft connector P3. Connect connector 3J2 on MHRS adapter to connector 1J2 TRANS on MC-2 control console using transmitter cable W2, Part No. 2580314 (part of MC-2 compass calibrator).

NOTE: Ensure FV - SYS SWITCH on MHRS ADAPTER is set to FV position.

(g) Position tripod (part of MC-2 compass calibrator) over previously surveyed monitor location and adjust tripod legs to convenient operating height.

NOTE: All operating personnel must be at least ten feet away and heavy power equipment at least eighty feet away from monitor when readings are taken in order to prevent magnetic disturbances and resultant errors.

(h) Mount and level monitor (part of MC-2 compass calibrator) on tripod. Connect connector located on bottom of monitor to connector 1J3 MONITOR on MC-2 control console using monitor cable W3, Part No. 2580315 (part of MC-2 compass calibrator).

CAUTION: POSITION POWER SUPPLY UNDER FUSELAGE AWAY FROM MONITOR AND FLUX VALVES.

(i) Connect connector 1J1 POWER on MC-2 control console to connector J805 on power supply (part of MC-2 compass calibrator) using power cable W1, Part No. 2598076 (part of MC-2 compass calibrator).

(j) Connect connector J805 on power supply to 28V dc power source.

(k) On pilots overhead circuit breaker panel CB1, ensure the following circuit breakers are engaged:

INSTR XFMR NO. 2 (D9)

INSTR XFMR NO. 3 (D27)

F/O RDDMI (E3)

INS PWR (E6) (aircraft with INERTIALS)

INS HTR (E7) (aircraft with INERTIALS)

CAPT RDDMI (E20)

CAPT HSI (F3)

INSTR XFMR NO. 1 (F5)

F/O HSI (F21)

DIR GYRO (G5) (aircraft without INERTIALS)

VG/INS-1 (G6) (aircraft with INERTIALS)

CMPS COUPLER (G7)

DIR GYRO (G23)

(aircraft without INERTIALS)

INS/VERT GYRO (G24) (aircraft with INERTIALS)

INS HTR (G25) (aircraft with INERTIALS)

CMPS CPLR (G26)

CMPS CPLR - 2 (J19)

RDDMI NO. 2 (J20)

CMPS CPLR - 1 (K19)

CMPS CPLR - 1 (K24)

RDDMI - 1 (K25)

(l) Turn on aircraft electrical power (Ref. 24-00-00).

(m) Verify equipment cooling is on (Ref. 21-25-00).

NOTE: On Captains and First Officers INSTRUMENT SOURCE SELECT panels, verify all switchlights are released, de-energized position. If on, depress and release switchlight, extinguishing ALTN legend. The HEADING message may appear on INSTR COMPARATOR during compass swing. At completion of compass swing, HEADING message must be out of view.

(n) If satisfactory magnetic heading reference system (No. 1 and No. 2) operation is unknown or questionable, place FV - SYS switch on MHRS

ADAPTER to SYS, then perform adjustment and test procedure (Ref. 34-22-00).

(o) Establish communications between flight station and technician at MC-2 control console (Ref. 23-43-00).

(p) On aircraft with INERTIALS, energize and set to ATT REF mode (Ref. 34-43-00).

(r) RADIOS must be on for standby magnetic compass calibration.

(3) Calibration Value Settings

(a) Open access door 535AT (535BT-1 on -500 aircraft) in left wing tip, zone 535 (Ref. 34-22-05). Record calibration values marked on flux valve No. 1.

(b) Set E1 CHECK control potentiometer on MC-2 control console to E1 check value marked on flux valve No. 1.

(c) Set E2 CHECK control potentiometer on MC-2 control console to E2 check value marked on flux valve No. 1.

(d) Set delta 180 crosstalk value marked on flux valve No. 1 to nearest 3-minute position on DELTA 180 MINUTES switch on MC-2 control console. Set DELTA 180 polarity switch on MC-2 control console to + or - as marked on flux valve No. 1.

(e) Set delta 270 crosstalk value marked on flux valve No. 1 to nearest 3-minute position on DELTA 270 MINUTES switch on MC-2 control console. Set DELTA 270 polarity switch on MC-2 control console to + or - as marked on flux valve No. 1.

(f) Set AREA COMP potentiometer on MC-2 control console to value determined when swing site was surveyed.

(g) Set MC-2 control console READOUT SELECT SWITCH to F.V., F.V. SELECT switch to 2 and MODE SELECTOR switch to MON.

NOTE: Periodically check exc volts meter and frequency meter to ensure proper values are being maintained.

(h) Set POWER ON - POWER OFF switch to POWER ON, adjust VOLTS ADJUST control for 23.5-volts indication on EXC VOLTS meter. Check that FREQUENCY meter indicates 400 ± 5-Hz.

(4) North-South Line Initial Bearing Determination

(a) Rotate monitor to sight reference target.

NOTE: Nominal bearing of reference target from magnetic north at monitor location recorded when swing site was surveyed. This value is a constant and will not change unless swing site is resurveyed.

(b) Set monitor azimuth scale to reference target bearing.

CAUTION: TO AVOID CABLE DAMAGE, DO NOT ROTATE MONITOR MORE THAN THAN 360-DEGREES IN ONE DIRECTION.

(c) Rotate monitor to 0, 90, 180 and 270-degree headings and record ERROR indicator readout (on MC-2 control console) for each position.

NOTE: Readout error is the difference between headings of monitor and and control console readouts. Errors are positive if white divisions appear in ERROR readout indicator and negative when red divisions appear.

(d) Add the four errors algebraically and divide by four. Record this value.

(e) Algebraically add flux valve location correction figure (obtained when swing site was surveyed) with value obtained in Step (4)(d). Record this value; it is the corrected monitor index figure.

(f) Rotate monitor to 0-degree heading. Record control console ERROR readout indication. This figure is used as reference to determine subsequent shifts in direction of earths magnetic field.

(g) Determine MISAL MINUTES setting (to be set into MC-2 control console) by adding figure obtained in Step (2)(e) to figure obtained in Step (4)(e). Set ± MISAL and MISAL MINUTES figures into MC-2 control console.

(5) Average E1 and E2 Swing Voltage Determination

(a) Set controls as follows on MC-2 control console:

READOUT SELECT to 90

E1 NORM-E1 REV TO E1 NORM

E2 NORM - E2 REV to E2 NORM

E1 - E2 CHECK to E1 CHECK

Adjust E1 VOLTS control for null on NULL INDICATOR and record E1 volts setting

E1 - E2 CHECK to E2 CHECK

Adjust E2 VOLTS control for null on NULL INDICATOR and record E2 volts setting

(b) Rotate monitor to 180-degree heading.

(c) Set controls as follows on MC-2 control console:

E1 - E2 CHECK to E1 CHECK

E1 NORM - E1 REV to E1 REV

E2 NORM - E2 REV to E2 REV

Adjust E1 VOLTS control for null on NULL INDICATOR and record E1 volts setting

E1 - E2 CHECK to E2 CHECK

Adjust E2 VOLTS control for null on NULL INDICATOR and record E2 volts setting

(d) Add E1 volts settings recorded in Steps (5)(a) and (5)(c) and divide by 2. Set this figure into E1 VOLTS CONTROL on MC-2 control console.

(e) Add E2 volts settings recorded in Steps (5)(a) and (5)(c) and divide by 2. Set this figure into E2 VOLTS CONTROL on MC-2 control console.

(f) Set controls as follows on MC-2 control console:

E1 NORM - E1 REV to E1 NORM

E2 NORM - E2 REV to E2 NORM

E1 - E2 CHECK to OFF

(6) MHRS No. 1 One-Cycle Error Compensation

NOTE: Verify HDG flags in HSIs are out of view.

(a) On MC-2 control console; set MODE SELECTOR to CAL and READOUT SELECT to F.V.

(b) In flight station; on MHRS No. 1 compass controller (pilots overhead console) depress MAG/DG pushbutton switchlight to light MAG legend.

(c) On MC-2 control console; set HEADING SELECTOR to 0-DEGREES. Loosen locknuts on magnetic compensator No. 1 N-S, E-W potentiometers.

NOTE: Magnetic Compensators are located in FESC just below flight compartment access on left side.

(d) On magnetic compensator No. 1 in FESC; adjust N-S potentiometer to obtain 0-minutes indication on MC-2 control console ERROR readout indicator.

(e) On MC-2 control console; set HEADING SELECTOR to 180-DEGREES. Note MHRS No. 1 ERROR readout indication and adjust N-S potentiometer on magnetic compensator No. 1 to remove 1/2 the error, i.e; if ERROR readout indication is + 24-minutes, adjust N-S potentiometer until ERROR readout indication is + 12-minutes.

(f) On MC-2 control console; set HEADING SELECTOR to 90-DEGREES. Adjust E-W potentiometer on magnetic compensator No. 1 to obtain 0 minutes indication on MC-2 control console ERROR readout indicator.

(g) On MC-2 control console; set HEADING SELECTOR to 270-DEGREES. Note MHRS No. 1 ERROR readout indication and adjust E-W potentiometer on magnetic compensator No. 1 to remove 1/2 the error, ie; if ERROR readout indication is minus 30-minutes, adjust E-W potentiometer until ERROR readout indication is minus 15-minutes.

(h) Tighten N-S and E-W potentiometer locknuts on magnetic compensator No. 1 until potentiometer shafts are tight, but still movable.

(j) On MC-2 control console; set HEADING SELECTOR to 0, 90, 180 and 270-DEGREES. Record ERROR readout indication for each heading.

(k) Determine N-S error by algebraically subtracting error at 180-degrees from error at 0-degrees and dividing by 2. Set MC-2 control console HEADING SELECTOR to 0-DEGREES and remove N-S error by adjusting N-S potentiometer on magnetic compensator No. 1 by an amount equal and opposite computed N-S error.

(l) Determine E-W error by algebraically subtracting error at 270-degrees from error at 90-degrees and dividing by 2. Set MC-2 control console HEADING SELECTOR to 90-DEGREES and remove E-W error by adjusting E-W potentiometer on magnetic compensator No. 1 by an amount equal and opposite computed E-W error.

(m) On MC-2 control console; set HEADING SELECTOR to 0, 90, 180 and 270-DEGREES. record ERROR readout indication for each heading. ERROR readout indication at 0-DEGREES shall equal ERROR readout indication at 180-DEGREES ± 12-MINUTES; ERROR readout indication at 90-DEGREES shall equal ERROR readout indication at 270-DEGREES ± 12-MINUTES.

(7) MHRS No. 1 24-Heading Swing

(a) Set MC-2 control console MODE SELECTOR to COMP and READOUT SELECT to EXT. CX.

(b) On MHRS adapter (Part No. 2575831, connected to magnetic compensator No. 1 in FESC) set FV - SYS switch to SYS position.

NOTE: Manually synchronize MHRS No. 1 (using compass controller No. 1 on pilots overhead console) after each heading change.

(c) On MC-2 control console; rotate HEADING SELECTOR in 15-degree increments and note heading indications on Captains HSI and First Officers RDDMI. Heading indications shall agree with MC-2 control console HEADING SELECTOR settings ± 2-DEGREES. If error exceeds ± 2-degrees; repeat Steps (4) through (7).

(d) On pilots overhead circuit breaker panel CB1; disengage and tag CMPS COUPLER (G7) and (G26) circuit breakers.

(e) On MC-2 control console; set POWER ON - POWER OFF switch to POWER OFF.

(f) In FESC; disconnect MHRS adapter (Part No. 2575831) from connector J1 on rear of magnetic compensator No. 1 and from aircraft connector P3. Connect aircraft connector P3 to connector J1 on rear of magnetic compensator No. 1. Remove aircraft connector P16 from connector J1 on rear of magnetic compensator No. 2. Connect cable with connector on MHRS adapter to connect J1 on rear of magnetic compensator No. 2. Connect cable with connector on MHRS adapter to connector J1 on rear of magnetic compensator No. 2. Connect connector 3J1 on MHRS adapter to aircraft connector P16.

(g) On MHRS ADAPTER; set FV - SYS switch to FV position.

(h) On pilots overhead circuit breaker panel CB1; remove tags, engage CMPS CPLR (G7) and (G26) circuit breakers and repeat Steps (3) through (7)(c) for MHRS No. 2.

NOTE: Flux valve No. 2 located in access opening 635AT (635BT-1 on -500 aircraft) in right wing tip, zone 635 (Ref. 34-22-05).

MHRS No. 2 heading information displayed on Captains RDDMI and First Officers HSI.

(j) On pilots overhead circuit breaker panel CB1; disengage and tag CMPS CPLR (G7) and (G26) circuit breakers.

(k) On MC-2 control console; set POWER ON - POWER OFF switch to POWER OFF.

(l) Disconnect power supply from 28V dc power source.

(m) In FESC; disconnect MHRS adapter from connector J1 on rear of magnetic compensator No. 2 and from aircraft connector P16. Connect aircraft connector P16 to connector J1 on rear of magnetic compensator No. 2.

(n) Disconnect and stow cables W1, W2 and W3, MHRS adapter, control console, power supply, monitor, and tripod in MC-2 compass calibrator kit.

(p) Close and secure access doors 535AT and 635AT (535BT-1 and 635BT-1 on -500 aircraft).

(q) On pilots overhead circuit breaker panel CB1; remove tags and engage CMPS CPLR (G7) and (G26) circuit breakers.

(r) On magnetic compensator No. 1:

Connect dc vtvm (+) probe to N-S test point and (+) probe to N-S test and (-) probe to COM test point.

Note voltage indication and inscribe on N-S VOLTS DC placard on magnetic compensator front panel.

Tighten N-S potentiometer locknut and recheck dc vtvm to ensure potentiometer has not moved.

Remove dc vtvm (+) probe from N-S test point and connect to E-W test point.

Note voltage indication and inscribe on E-W VOLTS DC placard on magnetic compensator front panel.

Tighten E-W potentiometer locknut and recheck dc vtvm to ensure potentiometer has not moved.

Disconnect dc vtvm (+) and (-) probes from magnetic compensator.

(s) Repeat Step (7)(r) on magnetic compensator No. 2.

(t) Close and secure access door 112AB.

(u) Turn off aircraft electrical power (Ref. 24-00-00).

(v) Turn OFF INERTIALS (Ref. 34-43-00), if installed.

B. Conventional Compass Swing

C (1) General

C (a) The magnetic heading reference systems (Nbr 1 and Nbr 2) are calibrated to minimize errors due to magnetic elements within the aircraft. This is accomplished by physically positioning the aircraft on NORTH-SOUTH line located in a magnetic-free area, and using special compass calibration equipment, or by reference to the INS systems if the aircraft is so equipped.

C (b) All L-1011 aircraft are equipped with locating pins to position the fluxvalve. Changing the

C fluxvalve does not establish a compass swing
C requirement. If the locating pin is damaged or
C missing, it may be replaced, since it screws into
C the fluxvalve mounting plate. The following
C compass swing procedures are for use only when
C abnormal conditions arise, such as wing tip damage
C or a requirement to accomplish metal repairs which
C would disturb the position of the fluxvalve
C bracketry or supporting structure.

C (c) The stand-by magnetic compass may be calibrated
C simultaneously with the MHRS systems, or may be
C calibrated separately using EQ 1025 test equipment
C (R&R 90173).

C (2) Special Tools Required

C Non-magnetic screwdriver.

C Digital Voltmeter - Beckman TECH 310 (or equivalent).

C On domestic L-1011-1-Compass Swing Tool - (TWA SPECIAL)
C - R&R 90219 (Includes 37840 Directional Gyro, D.G.
C mounting bracket and plate with ashtray adapters, and a
C control box with 65 feet of cable, and approximately 25
C feet of power cable.

C NOTE: Not required on L-1011-50 or -100 aircraft.

C Angle Position Indicator - TWA SPECIAL - R&R
C 90021.

C NOTE: Not required on L-1011-50 or -100 aircraft.

C Angle Position Indicator - TWA SPECIAL - R&R
C 90020.

C NOTE: Not required on L-1011-50 or -100 aircraft.

C An established compass calibration area with an
C accurately surveyed line painted magnetic
C north-south.

C (3) Preparation

C (a) Tow the airplane to the calibration area and
C establish a NORTH heading by reference to the nose
C wheel on the line and the main gear equidistant
C either side of the line.

C (b) Activate the following circuit breakers on the
C overhead circuit breaker panel CB1.

C 1) For Domestic L-1011 aircraft:

C Inst XFMR No. 2 (D9)

C Inst XFMR No. 3 (D27)

C F/O RDDMI (E3)

C CAPT RDDMI (E20)

C CAPT HSI (F3)

C INST XFMR NO. 1 (F5)

C F/O HSI (F21)

C DIR GYRO (G5)

C CMPS COUPLER (G7)

C DIR GYRO (G23)

C CMPS CPLR (G26)

C CMPS CPLR-2 (J19)

C RDDMI NBR 2(J20)

C CMPS CPLR-1 (K19)

C CMPS CPLR-1 (K24)

C RDDMI-1 (K25)

C 2) For international aircraft with INS equipment,
C close these additional circuit breakers on CB1
C panel:

C VG/INS-1 (G6)

C INS PWR (E6)

C INS HTR (E7)

C AREA NAV (E8)

C INS/VERT GYRO (G24)

C INS HTR (G25)

C AREA NAV (E26)

C ALT ALERT-2 (J21)

C INS 3/GYRO 3 (E24)

C INS 3 HTR (E25)

C ALT ALERT-2 (J21)

C CAPTS INSTR (E1)

C F/O INSTR (E2)

C ALTN ADI (E19)

C CAPT ADI (F2)

C F/O ADI (F20)

C AIR DATA CMPTR (G6)

C AIR DATA CMPTR (G27)

C 3) On domestic L-1011, connect the D.G. Swing
C Tool power cord to a power source, and, at the
C control box, turn on power and allow the D.G. to
C stabilize.

C 4) Connect the R&R 90020 and 90021 angle position
C indicators (API) to their respective sockets,
C locate them for easy viewing recording and taxi
C personnel.

C 5) Check equipment cooling airflow.

C a) On all aircraft, verify that equipment
C cooling is operative (Ref. 21-25-00).

C b) On INS equipped aircraft, also check INS
C cooling is operative (Ref. 21-25-00).

C 6) Check compass system operation.

C a) On L-1011-1 aircraft, press the MAG/D.G.
C switchlights to light the MAG legends and wait
C four minutes for the compass to synchronize.

C b) On INS equipped aircraft, place all three
C INS mode selector switches to NAV. Use local
C coordinates when inserting position, and allow
C all INS systems to align until the NAV READY
C green lights are on.

NOTE: Do not move the aircraft until all three NAV READY lights are lighted. Since compass D.G. information is derived from the INS systems, it will be necessary to align INS systems prior to compass synchronizing.

c) On INS equipped aircraft place RADIO-INS switch to INS.

7) Check that both Capt's and F/O's HDG ALTN switchlites, on the respective Instrument Source Select panels, are extinguished.

(4) Compass Swing Procedures

(a) For domestic L-1011 aircraft, using the D.G. swing Tool control box, slew the Steer API to the north heading of the aircraft. Check that both compasses indicate North on the HSI and RDDMI cards.

(b) For INS equipped aircraft, place the INS CDU selector switches to HDG/DA position and note the TRUE HEADING is indicated on the left display of the DCU's.

NOTE: Apply local magnetic variation (MAGVAR) to INS true heading to obtain magnetic heading. Local MAGVAR can be established by observing the difference between HSI card and INS display indications at magnetic north.

(c) Record HSI compass card and API (or corrected INS) indications at magnetic north.

(d) Tow the aircraft to point the nose toward the EAST as indicated by the Steer API (or corrected INS).

(e) Record the HSI card and Steer API (or corrected INS) heading.

(f) Tow the aircraft to point the nose SOUTH, as indicated by the Steer API (or corrected INS).

(g) Record the HSI card and Steer API (or corrected INS) headings.

(h) Tow the aircraft to point the nose WEST, as indicated by the Steer API (or corrected INS).

(i) Record the HSI card and Steer API (or corrected INS) headings.

(j) Tow the aircraft to again line up with the nose exactly NORTH.

NOTE: Aircraft position must be accurately established as in paragraph B.(3)(a) at the same position as originally located.

(k) Record the HSI card and Steer API (or corrected INS) indications.

(l) Establish that the compass system errors at the four headings do not exceed ± 1 degree at any heading. Errors may be corrected electrically. (Fluxvalves are positioned by a locating pin).

(m) Calculate D.G. swing tool drift for the period of the swing, and correct figures to prorate D.G. error at each heading. INS readings require no correction other than MAGVAR.

(n) Correct any compass errors by voltage correction at the compensators.

NOTE: Compass systems shall be accurate to ± 2° at all headings.

(o) Remove half of the N-S error by compensator N-S controls at a SOUTH heading, and remove half of the E-W error by compensator E-W controls at a WEST heading.

NOTE: The compensator controls are secured by lock-nuts. Loosen the nuts before attempting to move the controls, and tighten them to pervent vibration after corrections are made.

(p) Measure the voltages at the compensator box and record correction voltages for E-W and N-S. Inscribe these voltage values on metal placards as provided on the stanchions or crossmembers of the rack.

(q) Disconnect the D.G. Swing tool and allow the Directional Gyro to run down before moving. Moving the gyro when the rotor is in motion without sustaining power will cause extensive internal damage.

C C (r) On INS equipped aircraft, turn the INS mode selector panel mode switch to OFF. and Captains

C. Standby Compass Swing

(1) Equipment Required

Standby Compass Calibrator, Part No. 2591553-901, Sperry Flight Systems Division

Master Magnetic Compass, Part No. 2593239, Sperry Flight Systems Division

MC-2 Turntable, Part No. 2588223, Sperry Flight Systems Division (part of MC-2 Compass Calibrator)

MC-2 Tripod, Part No. 2587149-1, Sperry Flight Systems Division (part of MC-2 Compass Calibrator), or equivalent

Non-magnetic stand

Non-magnetic screwdriver

C (2) Preparation (If required)

NOTE: It is assumed that a surveyed swing site with an established north-south line has been prepared.

C C If standby compass calibrator accuracy is questionable, perform Paragraph (2).

(a) Set up turntable and tripod at swing site with tripod set over north-south line.

(b) Install master magnetic compass on standby compass calibrator.

(c) On standby compass calibrator:

Remove field cancelling assembly by removing thumbscrew

Remove field simulating assembly by loosening thumbscrew.

(d) Install standby compass calibrator on turntable and position turntable to obtain a north heading (0/360) on master magnetic compass.

NOTE: Perform following steps without moving relative position of master magnetic compass.

(e) Install field cancelling assembly and field simulating assembly on standby compass calibrator.

(f) Adjust top and bottom field simulating magnets so that both are positioned to indicate E at index line on standby compass calibrator.

(g) Adjust screw on field cancelling assembly to obtain 90-degree (E) indication on master magnetic compass.

(h) Adjust top and bottom field simulating magnets so that both are positioned to indicate W at index line on standby compass calibrator.

(j) Adjust screw on field cancelling assembly to remove 1/2 the error at 270-degree (W) indication on master magnetic compass.

(k) Repeat Steps (2)(f) and (2)(h) alternately, and adjust screw on field cancelling assembly as necessary to minimize indicated error on master magnetic compass.

(l) Remove master magnetic compass from standby compass calibrator and remove standby compass calibrator from turntable. Remove master magnetic compass, turntable and tripod from swing site.

(3) Standby Compass Swing

C (a) Deleted.

C (b) Tow aircraft into position over north-south line.

C NOTE: Angular distance between aircraft heading
C and north-south line must be less than
C 2-degrees. Before proceeding to Step (c); turn on aircraft electrical power (Ref. 24-00-00), verify equipment cooling system operation (Ref. 21-25-00) and energize communications systems, VHF (Ref. 23-11-00) and HF [Ref. 23-22-00 (if applicable)].

(c) At standby compass in flight station, zone 213, FS 158, WL 259; remove screws securing compensator coverplate on front of standby compass and remove

coverplate (compensator coverplate is lower coverplate with AIRPATH inscribed).

Remove top-right and bottom-left mounting screws securing standby compass to mounting bracket and install standby compass calibrator on standby compass, securing with two mounting screws previously removed.

C (d) Deleted.

C (e) Adjust top and bottom field simulating magnets so that both are positioned to indicate N at index line on standby compass calibrator. Record standby compass indication.

C (f) Adjust top and bottom field simulating magnets so both are positioned to indicate S at index line on standby compass calibrator. Record standby compass indication.

C (g) Correct for north-south error as follows:

Calculate deviation north (Dn);

Dn = MHn (north magnetic heading 0/360) - CHn
C [north reading on standby compass taken in Step
C (e)].

Calculate deviation south (Ds);

Ds = MHs (south magnetic heading 180) - CHs [south
C reading on standby compass taken in Step (f)].

Calculate error (c);

C = Dn - Ds divided by 2.

NOTE: Plus and minus signs must be taken into account when performing above calculations.

Adjust N-S compensator on standby compass until standby compass indicates CHs-C.

NOTE: Use non-magnetic screwdriver to adjust N-S compensator.

C (h) Adjust top and bottom field simulating magnets so that both are positioned to indicate E at index line on standby compass calibrator. Record standby compass indication.

C (i) Adjust top and bottom field simulating magnets so both are positioned to indicate W at index line on standby compass calibrator. Record standby compass indication.

C (j) Correct for east-west error as follows:

Calculate deviation east (De);

C De = MHe (east magnetic heading 90) - CHe [east reading on standby compass taken in Step (h)].

Calculate deviation west (Dw);

C Dw = MHw (west magnetic heading 270) - CHw[west reading on standby compass taken in Step (i)].

Calculate error (c);

C = De - Dw divided by 2.

NOTE: Plus and minus signs must be taken into account when performing above calculations.

Adjust E-W compensator on standby compass until standby compass indicates CHw-C.

NOTE: Use non-magnetic screwdriver to adjust E-W compensator.

C (k) Rotate top and bottom field simulating magnets in
C 30-degree increments and record magnetic heading
C and standby compass indication at each of the 12
C compass points. Deviation shall not exceed ±
C 8-degrees. If error exceeds ±8-degrees repeat
C Steps (e) through (j) until standby compass is
C within tolerance.

C (l) Enter magnetic heading at each 30-degree compass
C point (recorded in Step (1)) into FOR column of
C compass calibration card. Enter standby compass
C indication at each 30-degree compass point
C [recorded in Step (i)] into STEER column of M-2365
C compass calibration card and mark compass
C calibration card "WITH RADIOS ON". Use black
C Dymo tape-install on lower front of card housing.
C Place compass calibration card in holder in flight
C station.

C (m) Remove two screws securing standby compass calibrator to standby compass and remove standby compass calibrator. Replace two screws in

mounting holes, securing standby compass to mounting bracket.

C (n) Install compensator coverplate on standby compass and secure with screws.

C (o) Shut-down communications system, VHF (Ref. 23-11-00) and HF (Ref. 23-22-00).

C (p) Turn aircraft electrical power OFF (Ref. 24-00-00).

MAGNETIC HEADING REFERENCE SYSTEM - ADJUSTMENT AND TEST

1. Reference Procedure

24-00-00 Electrical Power - Maintenance Practices

2. Adjustment/Test

NOTE: Satisfactory performance of operational test (Step 2A) ascertains that the components of the MHRS under test (No. 1 or No. 2) are operable. If more detailed testing is to be performed, procedures in functional test (Step 2P) must be performed.

A. Operational Test

C NOTE: When accomplishing test in hangar with magnetic
C disturbances adjacent to wing tip flux valves, such
C as steel docks or other ground equipment, the
C Captain's and First Officer's heading indicators may
C disagree thus preventing completion of this test. In
CR such case, accomplish Steps (12) and (28) when
C aircraft is dehangared and away from magnetic
C disturbances.

(1) Turn on electrical power (Ref. 24-00-00).

(2) On FE/SO - ECS MONITOR panel, verify AVIONIC AIR - FWD and MID LO FLO lights are out.

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

INSTR CMPRN MON PWR (D8)

INSTR XFMR NO. 2 (D9)

CAPTS INSTR (E1)

F/O INSTR (E2)

F/O RDDMI (E3)

CAPT HSI (F3)

INSTR XFMR NO. 1 (F5)

CMPS COUPLER (G7)

ANN RESET (L9)

INSTR CMPRN MON (D26)

INSTR XFMR NO. 3 (D27)

CAPT RDDMI (E20)

F/O HSI (F21)

CMPS CPLR (G26)

CMPS CPLR-2 (J19)

RDDMI-2 (J20)

CMPS CPLR-1 (K19)

CMPS CPLR-1 (K24)

RDDMI NO. 1 (K25)

CAPT L (L20)

CAPT R (L21)

F/O R (L24)

F/O L (L25)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify the following circuit breakers are closed:

INSTR COOLING (A21)

F/O INSTR (E5)

CAPT IND LT TEST (H11)

PILOTS IND LTS (J2)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

MASTER RADIO PANEL (F5)

ESS RADIO BUS DC (F6)

ESS RADIO BUS AΦ (F7)

NO. 2 RADIO BUS MASTER CONT (AA12)

NO. 2 RADIO BUS Bϕ (AA15)

(4) In the forward electronic service center (FESC), zone 113, on the DG rack, verify maintenance annunciator on directional gyro No. 1 (DG-1) and directional gyro No. 2 (DG-2) is black.

(5) In FESC, on rear rack, shelf No. 1 (bottom), verify maintenance annunciator on compass couplers No. 1 and No. 2 is black.

(6) On MASTER RADIO panel in pilots overhead panel, verify OFF legends on ESSENTIAL and No. 2 switchlights are out. If on, latch switchlight turning OFF legend off.

(7) On compass controllers No. 1 (left) and No. 2 (right) in pilots overhead panel, zone 210, latch MAG/DG switchlight to DG. Verify that DG legend comes on.

(8) Select MAG mode on both compass controllers. Verify MAG legend comes on.

(9) Wait 4 minutes then continue.

(10) Within 4 minutes, HDG annunciators on Captains and First Officers horizontal situation indicators (HSI) change to MAG and HDG flags on First Officers and Captains radio digital distance magnetic indicators (RDDMI) retract from view.

(11) On compass controllers No. 1 and No. 2, verify compass annunciator is centered.

(12) On Captains and First Officers HSI and RDDMI, verify compass cards show approximately the same aircraft heading ±2.0 degrees. Record this heading.

C NOTE: When accomplishing test in hangar with steel
C docks adjacent to wing tip flux valves, the
C Captains and First Officers heading indicators
C may disagree thus preventing completion of this
C step. In such case, accomplish Step (12) when
C aircraft is dehangared and away from magnetic
C disturbances.

(13) On HEADING/PITCH MODE panel, adjust set heading control until aircraft heading is displayed in HEADING window. Verify Captains (First Officers) HSI heading select bug indicates aircraft heading.

CR (14) Step deleted.

NOTE: • Steps 2A(15) through 2A(30) perform an operational test on magnetic heading reference system No. 1 and No. 2. Each system must be checked separately. Designations in parentheses denote system No. 2 equipment.

• During tests in Steps 2A(15) through 2A(30), the heading select bug and selected course pointer must both move whenever the HSI compass card moves.

(15) On compass controller No. 1 (No. 2), latch MAG/DG switchlight to DG. Verify DG legend comes on. Position and hold set heading control to first CW position and verify corresponding HSI heading increases at a slow rate and HSI HDG flag is in view.

(16) When difference between HSI compass cards is six degrees, or greater, verify HEADING annunciator is in view on both Captains and First Officers INSTR COMPARATOR indicators. In DG mode, HDG will be annunciated on Captain (First Officer) HSI and HDG flag will be in view on First Officer (Captain) RDDMI during time controller is out of center, or detent position. If system is not defective, HDG will be replaced with MAG on HSI and flag will be out of view on RDDMI once controller is released to detent position.

(17) On compass controller No. 1 (No. 2), select and hold set heading control to second CW position and verify corresponding HSI heading increases at a fast rate and HSI HDG flag is in view.

(18) On compass controller No. 1 (No. 2) select and hold in turn, first and second CCW positions and verify corresponding HSI heading decreases at a slow and fast rate with HDG flag in view.

(19) Release set heading control and verify corresponding HSI heading is stationary and HSI HDG flag is out of view.

(20) On compass controller No. 1 (No. 2), use set heading control to set Captain (F/O) HSI to a heading of approximately 60 degrees greater than noted in Step 2A(12).

(21) On First Officers (Captains) INSTRUMENT SOURCE SELECT panel, latch the ALTN HDG switchlight. Verify ALTN legend comes on.

(22) On Captains and First Officers HSI, verify compass cards indicate same heading within ±2.0 degrees and MAG annunciator on Captains (First Officers) HSI is in view.

(23) On Captains and First Officers INSTR COMPARATOR indicators, verify HEADING annunciators are out of view.

(24) On First Officers (Captains) INSTRUMENT SOURCE SELECT panel, unlatch ALTN HDG switchlight. Verify ALTN legend goes out.

(25) On compass controller No. 1 (No. 2), unlatch MAG/DG switchlight to MAG. Verify MAG legend comes on.

(26) On Captains (First Officers) HSI, verify MAG annunciation changes to HDG. On First Officers (Captains) RDDMI, verify HDG flag is in view.

(27) On compass controller No. 1 (No. 2), verify compass annunciator deflects right.

(28) The HEADING annunciators on both INSTR COMPARATORs change to black (blank) when difference between HSI compass cards is seven degrees or less; Captains (First Officers) HSI HDG annunciator changes to MAG, RDDMI flags disappear, and compass cards must return to within 3.0 degrees of heading recorded in Step 2A(12) in less than 30 seconds.

C NOTE: When accomplishing test in hangar with steel
C docks adjacent to wing tip flux valves, the
C Captain's and First Officer's heading indicators
C may disagree thus preventing completion of this
C step. In such case, accomplish Step (28) when
C aircraft is dehangared and away from magnetic
C disturbances.

(29) On compass controller No. 1 (No. 2), latch MAG/DG switchlight to DG. Verify DG legend comes on. Position and hold set heading control in second CW position for 15 seconds and release.

(30) The HEADING annunciators on both INSTR COMPARATORS are in view when difference between HSI compass cards is six degrees, or greater. HDG will be annunciated on Captain (First Officer) HSI and HDG flag will be in view on First Officer (Captain) RDDMI during time controller is out of center, or detent position. If system is not defective, HDG will be replaced with MAG

on HSI and flag will be out of view on RDDMI once controller is released to detent position.

B. Functional Test

(1) Perform procedures outlined in Paragraph 2A.

(2) On compass controller No. 1 (No. 2), latch MAG/DG switchlight to DG. Verify DG legend comes on.

NOTE: Two technicians are required to perform Steps 2B(3) through (7). One rotates DG-1 (DG-2) and the other observes the HSI and RDDMI.

(3) In the FESC, zone 113, on the DG rack, loosen the knurled knobs securing DG-1 (DG-2) to its mount. Remove DG-1 (DG-2) from its mount and rotate DG-1 (DG-2) 90 degrees CW. Return DG-1 (DG-2) to its mount with base against flange at rear of mount.

(4) On Captains (First Officers) HSI and First Officers (Captains) RDDMI, verify compass cards indicate 90 (±5) degrees greater than heading recorded in Step 2A(11).

(5) Remove DG-1 (DG-2) from its mount and rotate DG-1 (DG-2) 180 degrees CCW. Return DG-1 (DG-2) to its mount with base against flange at rear of mount.

(6) On Captains (First Officers) HSI and First Officers (Captains) RDDMI, verify compass cards indicate 90 (±5) degrees less than heading recorded in Step 2A(11).

(7) Return DG-1 (DG-2) to normal position and secure with knurled knobs. Verify maintenance annunciator on DG-1 (DG-2) is black.

(8) Verify maintenance annunciators on compass couplers No. 1 and No. 2 are black.

(9) Turn off electrical power (Ref. 24-00-00).

MAGNETIC HEADING REFERENCE SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

2. Reference Procedures

24-00-00 Electrical Power - Maintenance Practices

34-43-00 Inertial System - Adjustment and Test

3. Adjustment/Test

CR NOTE: When accomplishing test in hangar with magnetic
CR disturbances adjacent to wing tip flux valves, such as
CR steel docks or other ground equipment, the Captains's and
CR First Officer's heading indicators may disagree thus
CR preventing completion of this test. In such case,
CR accomplish Steps (12) and (30) when aircraft is
CR dehangared and away from magnetic disturbances.

NOTE: Satisfactory performance of operational test (Paragraph 3A) ascertains that components of MHRS under test (No. 1 or No. 2) are operable.

A. Operational Test

(1) On center console, verify RADIO/INS switchlight is selected to RADIO.

(2) Turn on electrical power (Ref. 24-00-00).

(3) On FE/SO - ECS MONITOR panel, verify AVIONIC AIR - FWD, MID and INS COOLING LO FLO lights are out.

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

INSTR CMPRN MON PWR (D8)

INSTR XFMR NO. 2 (D9)

CAPTS INSTR (E1)

F/O INSTR (E2)

F/O RDDMI (E3)

INS PWR (E6)

INS HTR (E7)

CAPT HSI (F3)

INSTR XFMR NO. 1 (F5)

VG/INS-1 (G6)

CMPS COUPLER (G7)

ANN RESET (L9)

INSTR CMPRM MON (D26)

INSTR XFMR NO. 3 (D27)

CAPT RDDMI (E20)

F/O HSI (F21)

INS/VERT GYRO (G24)

INS HTR (G25)

CMPS CPLR (G26)

CMPS CPLR-2 (J19)

RDDMI-2 (J20)

CMPS CPLR-1 (K19)

CMPS CPLR-1 (K24)

CAPT L (L20)

CAPT R (L21)

F/O R (L24)

F/O L (L25)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify following circuit breakers are closed:

INSTR COOLING (A21)

F/O INSTR (E5)

PILOTS IND LTS (J2)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

INS COOLING FAN CONT (H6)

INS COOLING FAN POWER (H8)

MASTER RADIO CONT (F5)

ESS RADIO BUS DC (F6)

ESS RADIO BUS Aϕ (F7)

NO. 2 RADIO BUS MASTER CONT (AA12)

NO. RADIO BUS Bϕ (AA15)

(5) In FESC, verify maintenance annunciators on compass couplers No. 1 and No. 2 are black.

(6) On MASTER RADIO panel in pilots overhead panel, verify OFF legends on ESSENTIAL and No. 2 switchlights are
R off. If on, latch switchlight turning OFF legend off.

(7) Turn on inertial systems and select ATT mode.

(8) On compass controllers No. 1 (left) and No. 2 (right) located in pilots overhead panel, zone 210, latch MAG/DG switchlight to DG. Verify DG legend comes on.

(9) Select MAG mode on both compass controllers. Verify MAG legend comes on.

NOTE: Wait 4 minutes, then continue to Step 3A(10).

(10) On Capt (F/O) horizontal situation indicator (HSI) located on Capt/(F/O) instrument panel, zone 211 (212), verify HDG flag is not in view. On F/O (Capt) radio digital distance magnetic indicator (RDDMI) located on F/O (Capt) instrument panel, zone 212 (211), verify HDG flag is not in view.

(11) On compass controllers No. 1 and No. 2, verify compass annunciator is centered.

(12) On Captains and First Officers HSI and RDDMI, verify compass cards show approximately same aircraft heading ±2.0 degrees. Record this heading.

C NOTE: When accomplishing test in hangar with steel
C docks adjacent to wing tip flux valves, the

C Captain's and First Officer's heading indicators
C may disagree thus preventing completion of this
C step. In such case, accomplish Step (12) when
C aircraft is dehangared and away from magnetic
C distrubances.

(13) On HEADING/PITCH MODE panel, set heading control so aircraft heading is displayed in HEADING window. Verify Capt (F/O) HSI heading select bug indicates aircraft heading.

(14) On NAV MODE select panel, set left (right) COURSE control so aircraft heading is indicated in COURSE window. Verify Capt (F/O) selected course pointer indicates selected heading.

NOTE: • Steps 3A(15) through 3A(31) perform operational test on magnetic heading reference system No. 1 and No. 2. Each system should be checked separately. Designations in parentheses denote system No. 2 equipment.

• During tests in Steps 3A(31) heading select bug and selected course pointer must both move whenever HSI compass card moves.

(15) On compass controller No. 1 (No. 2), latch MAG/DG switchlight to DG. Verify DG legend comes on. Position and hold set heading control to first CW position and verify corresponding HSI heading increases at slow rate and HSI HDG flag is in view.

(16) When difference between HSI compass cards is six degrees, or greater, verify HEADING annunciator is in view on both Captains and First Officers INSTR COMPARATOR indicators. In DG mode, HDG will be annunciated on Capt (F/O) HSI and HDG flag will be in view on F/O (Capt) RDDMI during time set heading control is out of center, or detent position. If system is not defective, HDG will be replaced with MAG on HSI and flag will be out of view on RDDMI once controller is released to detent position.

(17) On compass controller No. 1 (No. 2), select and hold set heading control to second CW position, verify corresponding HSI heading increases at fast rate and HSI HDG flag is in view.

(18) On compass controller No. 1 (No. 2), select and hold in turn, first and second CCW positions and verify corresponding HSI heading decreases at slow and fast rate with HSI flag in view.

(19) Release set heading control, verify corresponding HSI heading is stationary and HSI HDG flag is out of view.

(20) On Captains (F/O) compass controller, use set heading control to set each HSI to heading of approximately 60 degrees greater than noted in Step 3A(12).

(21) On F/O (Capt) INSTRUMENT SOURCE SELECT panel, latch ALTN HDG switchlight. Verify ALTN HDG legend comes on.

(22) On Captains and First Officers HSI, verify compass cards indicate same heading within ±2.0 degrees and MAG annunciator on Capt (F/O) HSI is in view.

(23) On Captains and First Officers INSTR COMPARATOR indicators, verify HEADING annunciators are out of view.

(24) On F/O (Capt) INSTRUMENT SOURCE SELECT panel, latch ALTN HDG switchlight. Verify ALTN HDG legend goes out.

(25) On compass controller No. 1 (No. 2), depress MAG/DG switchlight to DG. Verify DG legend comes on. Position and hold set heading control to second CW position for 15 seconds and release.

(26) The HEADING annunciators on both INSTR COMPARATORS are in view when difference between HSI compass cards is 6.0 degrees, or greater. HDG annunciator will be in view on Capt (F/O) HSI and HDG flag will be in view on F/O (Capt) RDDMI during time compass controller No. 1 (No. 2) is out of center or detent position. If system is not defective, HDG will be replaced with MAG on HSI and HDG flag will be out of view on RDDMI once controller is released to detent position.

(27) On compass controller No. 1 (No. 2), unlatch MAG/DG switchlight to MAG. Verify MAG legend comes on.

(28) On Capt (F/O) HSI, verify MAG annunciation changes to HDG. On F/O (Capt) RDDMI, verify HDG flag is in view.

(29) On compass controller No. 1 (No. 2), verify compass annunciator deflects right.

(30) The HEADING annunciators on both INSTR COMPARATORS change to black (blank) when difference between HSI compass cards is 7.0 degrees or less; Capt (F/O) HSI HDG annunciator changes to MAG, RDDMI flags disappear, and compass cards return to within 3.0 degrees of heading recorded in Step 3A(12) within 30 seconds.

C NOTE: When accomplishing test in hangar with steel
C docks adjacent to wing tip flux valves, the
C Captain's and First Officer's heading indicators
C may disagree thus preventing completion of this
C step. In such case, accomplish Step (30) when
C aircraft is dehangared and away from magnetic
C disturbances.

(31) Turn inertial systems to OFF.

NOTE: Inertial batteries will discharge upon aircraft power removal if inertial systems are not placed in off position.

(32) Turn off electrical power (Ref. 24-00-00).

MAGNETIC COMPENSATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

	24-00-00	Electrical Power - Maintenance Practices
R	34-22-00	Magnetic Heading Reference System - Adjustment and Test
R R	34-43-00	Inertial Navigation System - Adjustment and Test (aircraft with inertials)

2. Equipment and Materials

Electronic voltmeter (dc vtvm), Millivac Instruments Inc., Model MV-17C, or equivalent

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION - CMPS COUPLER (G7) and NO. 2 NAVIGATION - CMPS CPLR.

(2) Open access door 112AB and enter forward electronic service center, zone 113. Locate magnetic compensator No. 1 and magnetic compensator No. 2 at FS 233/WL 194/BL 12L (Ref. Fig. 401).

(3) Note VOLTS DC setting for N-S, E-W potentiometers written on compensator front panel placards.

(4) Release Dzus fasteners and pull magnetic compensator forward.

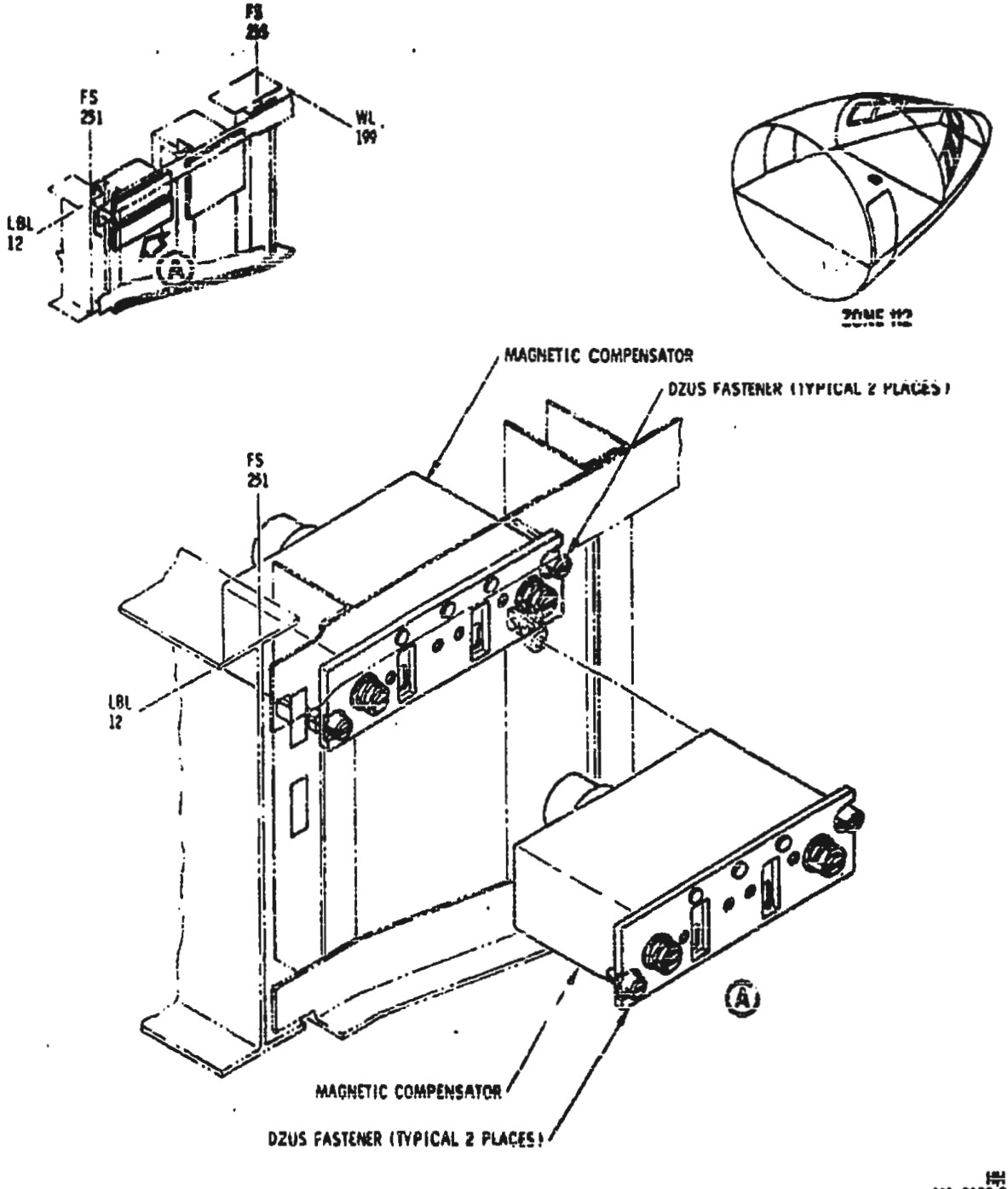
(5) Disconnect connector from magnetic compensator receptacle. Remove magnetic compensator.

B. Installation

(1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

(2) Connect connector to magnetic compensator receptacle.

(3) Install magnetic compensator and secure Dzus fasteners.



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Magnetic Compensator - Removal and Installation
Figure 401

(4) Remove tags and close circuit breakers opened in Step 3A(1).

(5) Turn aircraft electrical power ON (Ref. 24-00-00).

(6) On FE/SO ECS MONITOR panel, ensure AVIONIC AIR-FWD and MID COOLING LO FLO lights are out.

NOTE: On aircraft with inertials, ensure INS COOLING LO FLO light is also out.

(7) R On aircraft with inertials installed, energize applicable inertial system and set to ATT mode (Ref. 34-43-00).

(8) Press MAG pushbutton switch on applicable compass controller. Allow 5-minute warmup.

(9) Connect DC vtvm between N-S VOLTS DC test point (+) and COM(-) test point on compensator front panel. Adjust N-S potentiometer for voltage indication noted in Step A(3). Tighten N-S potentiometer lock nut. Recheck voltage and readjust as necessary.

(10) Disconnect dc vtvm from N-S VOLTS DC test point (+) and connect to E-W VOLTS DC test point. Adjust E-W potentiometer for voltage indication noted in Step A(3). Tighten E-W potentiometer lock nut. Recheck voltage and readjust as necessary.

(11) Disconnect dc vtvm.

(12) Write voltage settings of Steps B(8) and B(9) on N-S and E-W VOLTS DC placards on compensator front panel.

(13) Perform magnetic heading reference system adjustment and test procedure (Ref. 34-22-00).

(14) Close and secure access door.

(15) Turn all inertial systems to OFF.

NOTE: Inertial Batteries may discharge upon power removal if mode select switch is NOT set to OFF.

(16) Turn aircraft electrical power OFF (Ref. 24-00-00).

COMPASS CONTROLLER - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-22-00 Magnetic Heading Reference System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 NAVIGATION - CMPS COUPLER (G7) or NO. 2 NAVIGATION - CMPS CPLR (G26) circuit breakers.

      (2) Locate two compass controllers on pilots overhead panel, zone 210, (Ref. Fig. 401).

      (3) Release Dzus fasteners securing compass controller to be removed from pilots overhead panel.

      (4) Pull compass controller out of recess in pilots overhead panel and disconnect connector from receptacle. Remove compass controller.

   B. Installation

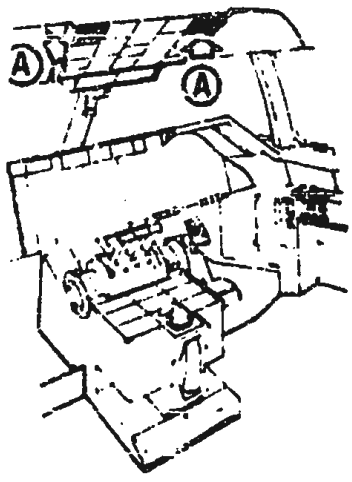
      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Connect connector to receptacle on rear of compass controller.

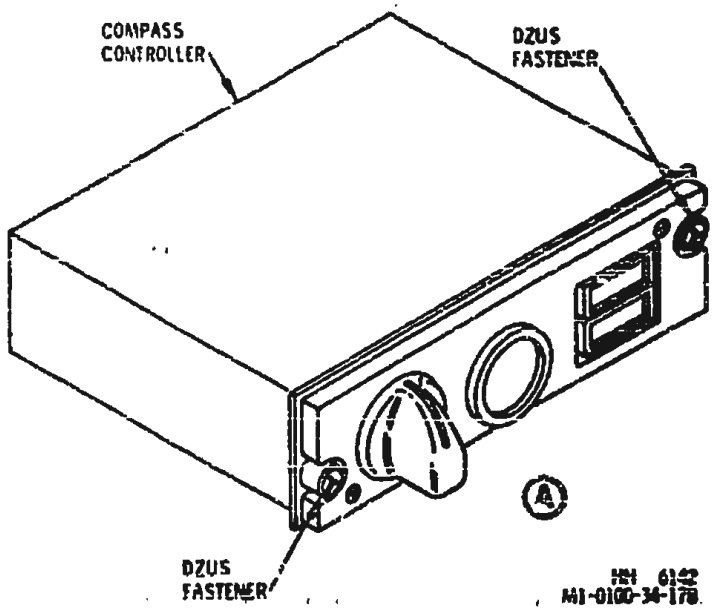
      (3) Place compass controller in recess in pilots overhead panel and secure Dzus fasteners.

      (4) Remove tags and close circuit breakers opened in Step 2A(1).

      (5) Perform magnetic heading reference system adjustment and test (Ref. 34-22-00)



ZONE 210



Compass Controller - Removal and Installation
Figure 401

COMPASS COUPLER - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-22-00 Magnetic Heading Reference System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 NAVIGATION - CMPS COUPLER (G7) and NO. 2 NAVIGATION - CMPS CPLR (G26) circuit breakers.

      (2) Open access door 112AB and enter forward electronic service center, zone 113. Locate two compass couplers on forward electronics service center left rear rack, shelf 1 (Ref. Fig. 401).

      (3) Loosen and disengage knurled knob securing compass coupler to be removed.

      (4) Pull compass coupler forward to disconnect rear connectors. Remove compass coupler.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Position compass coupler on mount. Push coupler back to mate rear connectors.

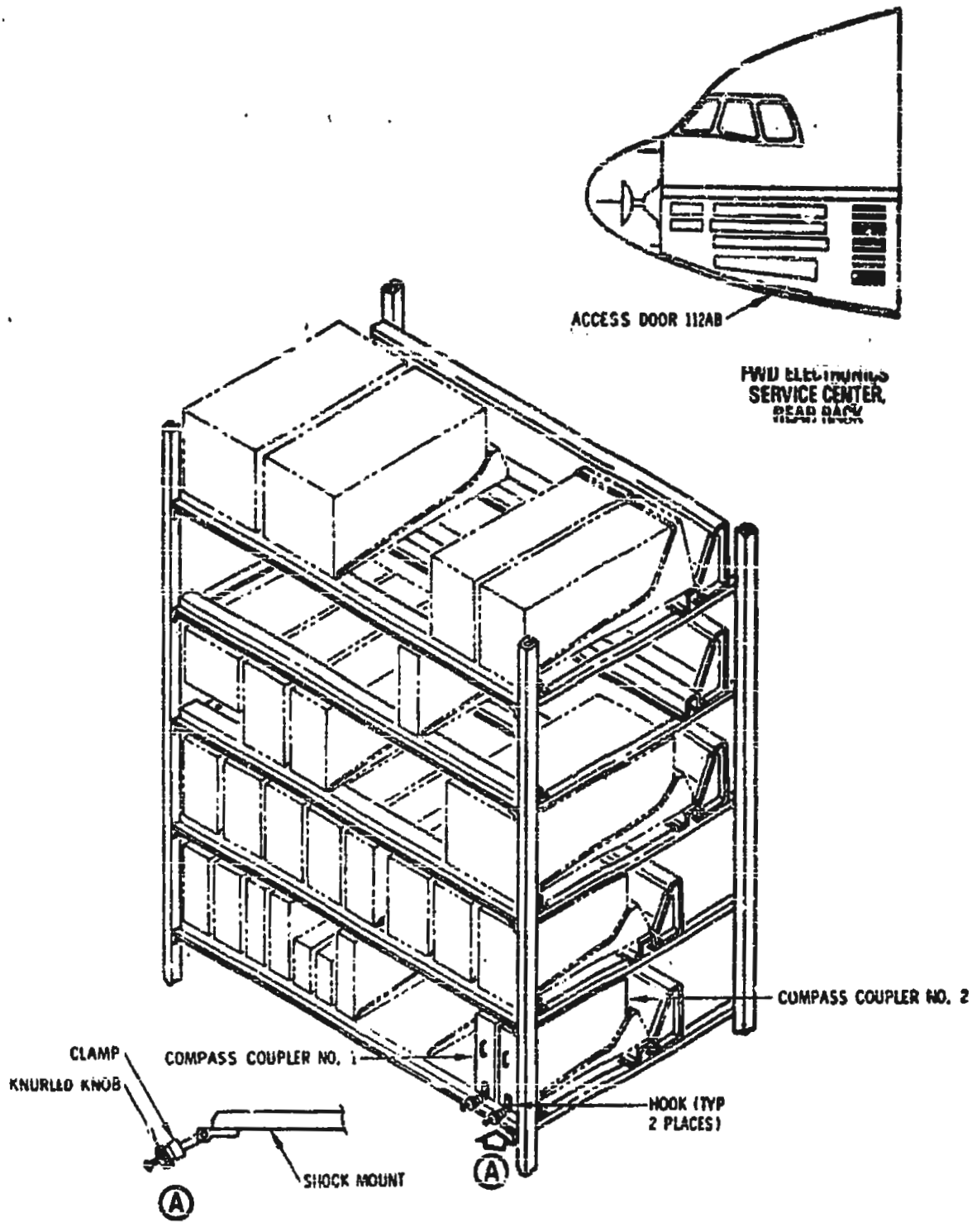
      (3) Place holddown clamp over compass coupler hook.

      (4) Tighten knurled knob securing compass coupler to mount.

      (5) Close and secure access door.

      (6) Remove tags and close circuit breakers opened in Step 2A(1).

CR CR (7) Perform magnetic heading reference system operational test (Ref. 34-22-00, Page 501).



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Compass Coupler - Removal and Installation
Figure 401

DIRECTIONAL GYRO - MAINTENANCE PRACTICES

1. General

The following procedure specifies the method used to de-activate No. 1 or No. 2 directional gyro if aircraft is to be dispatched with one gyro inoperative.

NOTE: This de-activation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

2. De-activation

A. On pilots overhead circuit breaker panel CB1, open and tag one of the following circuit breakers as appropriate:

NO. 1 NAVIGATION - DIR GYRO (G5) or

NO. 2 NAVIGATION - DIR GYRO (G23)

B. On Capt or F/O INSTRUMENT SOURCE SELECT panels (depending on which MHRS has been de-activated) press ALTN HDG and ALTN DEV switchlights, lighting ALTN legend. This transfers both HSI heading and VOR/ILS deviation inputs to the active system.

NOTE: DG No. 1 drives compass cards on Capt HSI and F/O RDDMI and DG No. 2drives compass cards on F/O HSI and Capt RDDMI.

NOTE: When ALTN HDG is selected (Step B), only HSI compass card input is switched, corresponding RDDMI compass card will be inoperative.

NOTE: Applicable RDDMI bearing pointer (No. 1 or No. 2) on each indicator will be inoperative on each indicator if applicable VOR/ADF switch is set to VOR. Applicable VOR receiver will be inoperative as MHRS reference input has been de-activated.

C. On Capt or F/O INSTRUMENT SOURCE SELECT panels (depending on which MHRS has been de-activated) press ALTN FLT DIR switchlight, lighting ALTN legend. This transfers both APFDS to active system.

D. On NAV MODE select panel, set VOR switch to 1 or 2 as applicable after NAV mode is selected.

E. Placard flight station as follows:

DIRECTIONAL GYRO (MHRS) DE-ACTIVATED (Specify No. 1, or No. 2)

DEGRADED OPERATION OF (Capt or F/O systems)

RDDMI HDG FLAG IN VIEW

AFFECTED RDDMI ADF POINTERS WILL INDICATE RELATIVE BEARING TO STATION, BUT COMPASS CARD REFERENCE WILL BE INOPERATIVE.

AFFECTED RDDMI VOR BEARING POINTER (No. 1, or No. 2) WILL BE INOPERATIVE (applicable pointer flag in view).

AFFECTED AFCS AND FLIGHT DIRECTOR WILL NOT ENGAGE. (See Step C.)

F. Make appropriate entry in aircraft log book.

DIRECTIONAL GYRO - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-22-00 Magnetic Reading Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 NAVIGATION DIR GYRO (G5) and NO. 2 NAVIGATION DIR GYRO (G23) circuit breakers.

(2) Open access door 112AB and enter forward electronics service center, zone 112. Locate two directional gyros on rack at FS 164.00, WL 156.00 (Ref. Fig. 401).

R (3) Disconnect aircraft cable connector from receptacle J1 on directional gyro to be removed.

(4) Loosen and disengage knurled knobs securing directional gyro (DG) to mount.

B. Installation

(1) Verify circuit breakers opened in Step A(1) are open and tagged.

(2) Position directional gyro on mount and place mount holddown clamps over directional gyro hooks.

(3) Tighten knurled knobs securing directional gyro to mount.

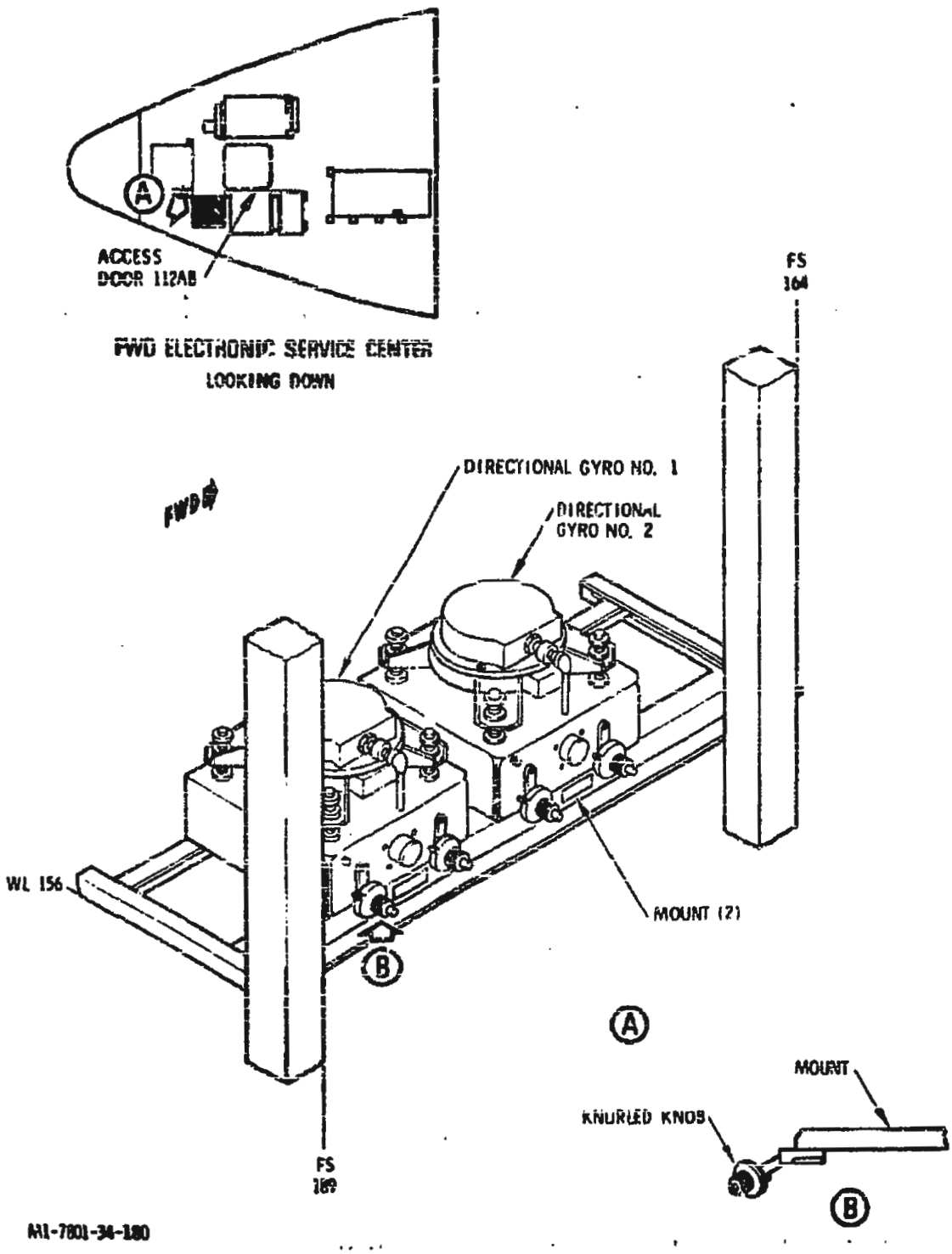
R (4) Connect aircraft cable connector to receptacle J1 on front of directional gyro.

(5) Close and secure access door 112AB.

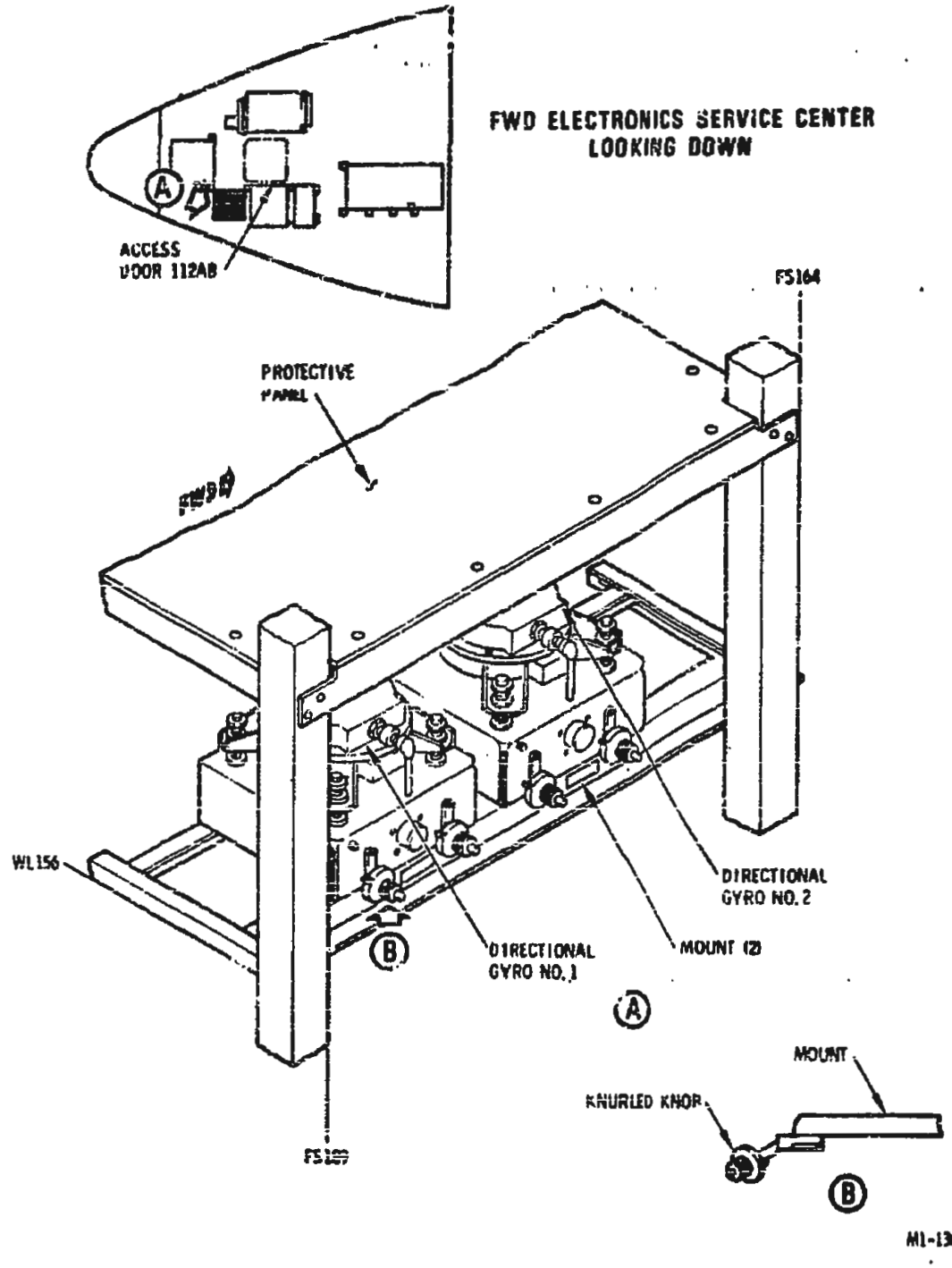
(6) Remove tags and close circuit breakers opened in Step A(1).

R C. Verify directional gyro operation.

R (1) Rotate DG 90° (±) 10° each direction slowly, note that
R associated HSI indication follows.



Directional Gyro - Removal and Installation
Figure 401



Directional Gyro - Removal and Installation
Figure 401

EFFECTIVITY: DG EQUIPPED

0019

R R (2) Secure DG in its mount and verify the maintenance annunciator is black.

R (3) Complete installation as in Steps 2B(2) through (6).

C FLUX VALVE - REMOVAL AND INSTALLATION

C 1. Referenced Procedure

C 34-22-00 Magnetic Reference System - Adjustment and Test

C 2. Removal/Installation

C NOTE: The following procedure incorporates MO 89844.

C A. Removal

C (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 NAVIGATION - COMP COUPLER (G7) or NO. 2 NAVIGATION - COMP CPLR (G26) circuit breakers depending on which flux valve is to be replaced.

C (2) Open access door 535AT (at left wing tip) for access to flux valve No. 1, or 635AT (at right wing tip) for access to flux valve No. 2 (Ref. Fig. 401).

C (3) Remove wire harness from flux valve terminals. Replace screws and lockwashers in flux valve terminal board.

C (4) Remove screws from flux valve slotted mounting bracket and remove flux valve. Retain screws for installation.

C B. Installation

C (1) Verify that circuit breaker opened in Step A(1) are open and tagged.

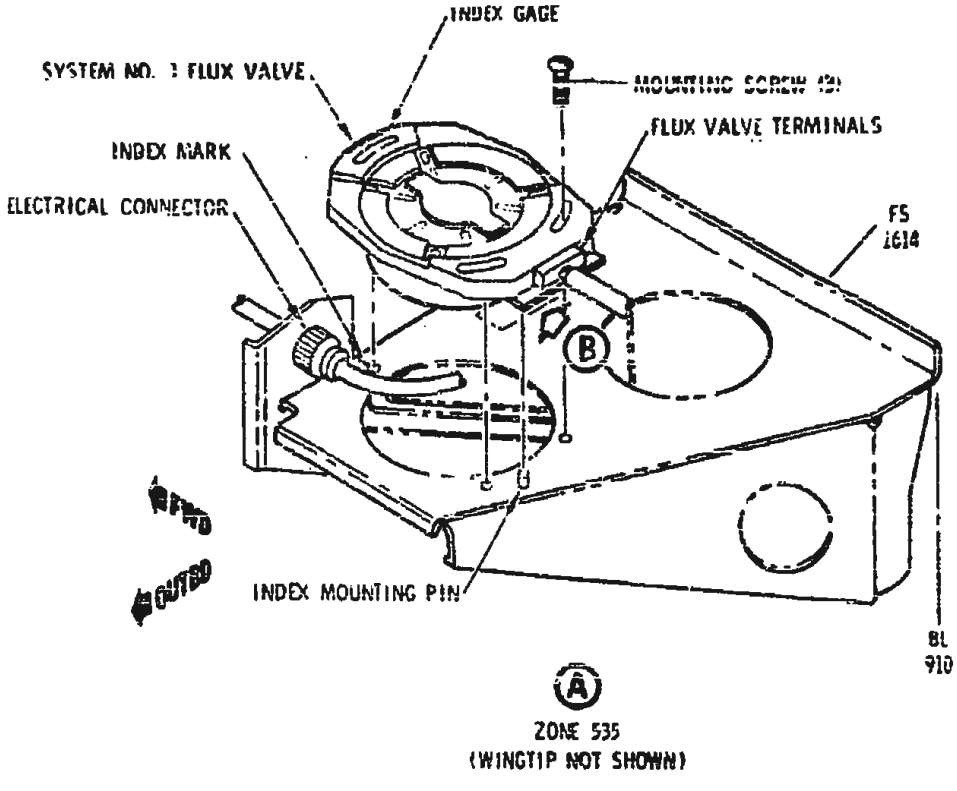
C (2) Position flux valve, aligning pin with indexing hole in bottom of flux valve and index mark with gage at front of flux valve.

CR CAUTION: USE NONMAGNETIC MOUNTING SCREWS ONLY.

C (3) Install and tighten mounting screws.

C (4) Remove screws and lockwashers from flux valve terminals, then replace screws and lockwashers connecting wire harness to flux valve terminals as indicated in Table 401. Tighten screws.

CR NOTE: Should it be necessary to replace flux valve terminals, use terminals TWA Stk. Nbr. 41-5919. When installing these terminals, use AMP 59275 T-head tool, TWA Stk. Nbr. 47-4153.



NOTE

- SYSTEM NO. 1 FLUX VALVE (LEFT) SHOWN
- SYSTEM NO. 2 FLUX VALVE (RIGHT) INSTALLATION IDENTICAL EXCEPT LOCATED AT ZONE 635, UNDER ACCESS DOOR 635AT
- ACCESS DOOR SECURED WITH 6 NAS4503U2 BOLTS
- AIRCRAFT 001 THROUGH 014

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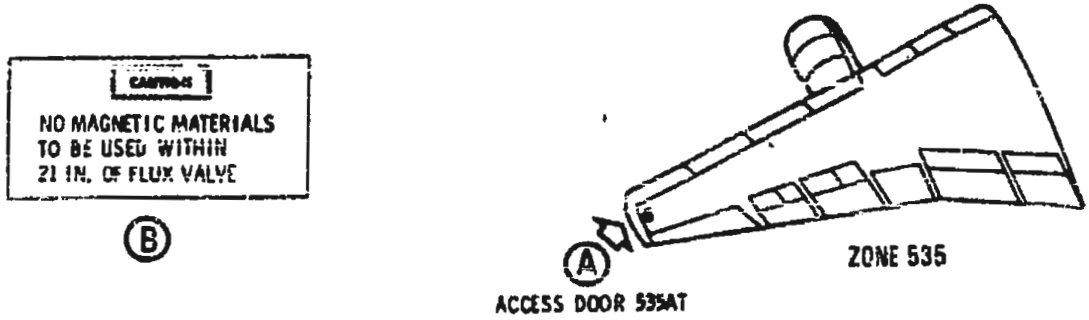
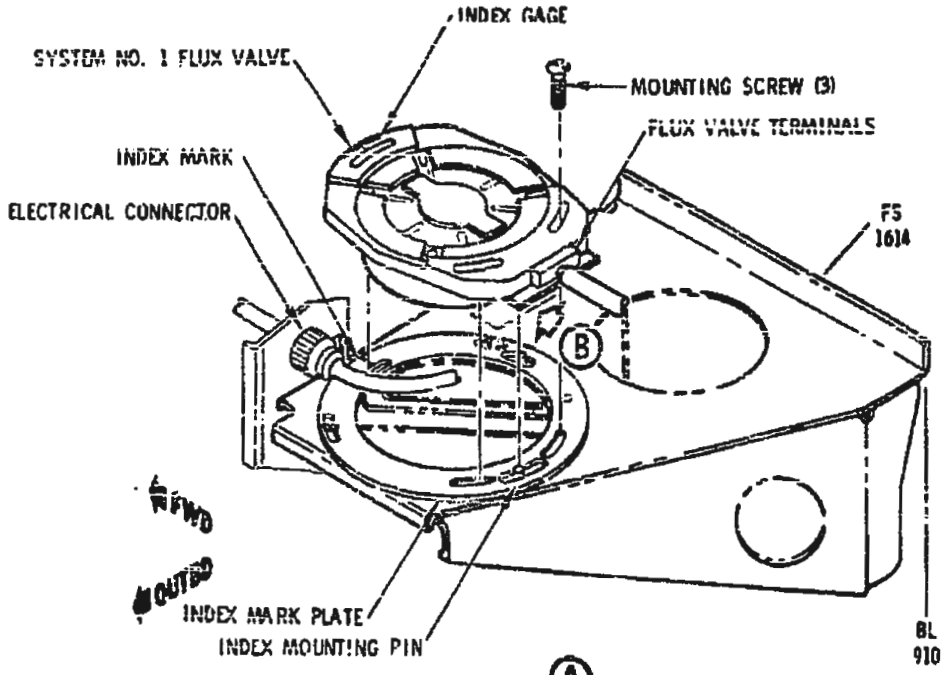
R R Flux Valve - Removal and Installation
Figure 401





NOTE

- SYSTEM NO. 1 FLUX VALVE (LEFT) SHOWN
- SYSTEM NO. 2 FLUX VALVE (RIGHT) INSTALLATION IDENTICAL EXCEPT LOCATED AT ZONE 635, UNDER ACCESS DOOR 635AT
- ACCESS DOOR SECURED WITH 6 NAS4503U2 BOLTS
- INDEX MARK PLATE RIVETED IN POSITION
- AIRCRAFT 015 THROUGH 999

M1-5002-34-1491

R R Flux Valve - Removal and Installation
Figure 401

Flux Valve Wire Harness Terminal Connections
Table 401

FLUX VALVE TERMINAL	WIRE NO. (LEFT WING)	WIRE NO. (RIGHT WING)
A	9000A20	9006A20
B	9001A20	9007A20
C	9002A20	9008A20
D	9003A20	9009A20
E	9004A20	9010A20
F	9005A20	9011A20

(5) Close and secure access door.

(6) Remove tag and close circuit breaker opened in Step A(1).

(7) Perform magnetic heading reference system operational test (Ref. 34-22-00, Page 501).

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HEADING COUPLER ACCESSORY UNIT REMOVAL AND INSTALLATION

1. Reference Procedures

22-12-03	Flight Director Basic Mode - Fault Isolation
34-22-00	Magnetic Heading Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

ALT SOURCE SEL CAPTS INSTR (E1)

ALT SOURCE SEL F/O INSTR (E2)

CMPS COUPLER (G7)

CMPS CPLR (G26)

CMPS CPLR 2 (J19)

CMPS CPLR 1 (K19)

CMPS CPLR 1 (K24)

R (2) Open access door 112AB and enter forward electronic service center, zone 113. Locate heading coupler accessory unit on rear rack, shelf 1 (Ref. Fig. 401).

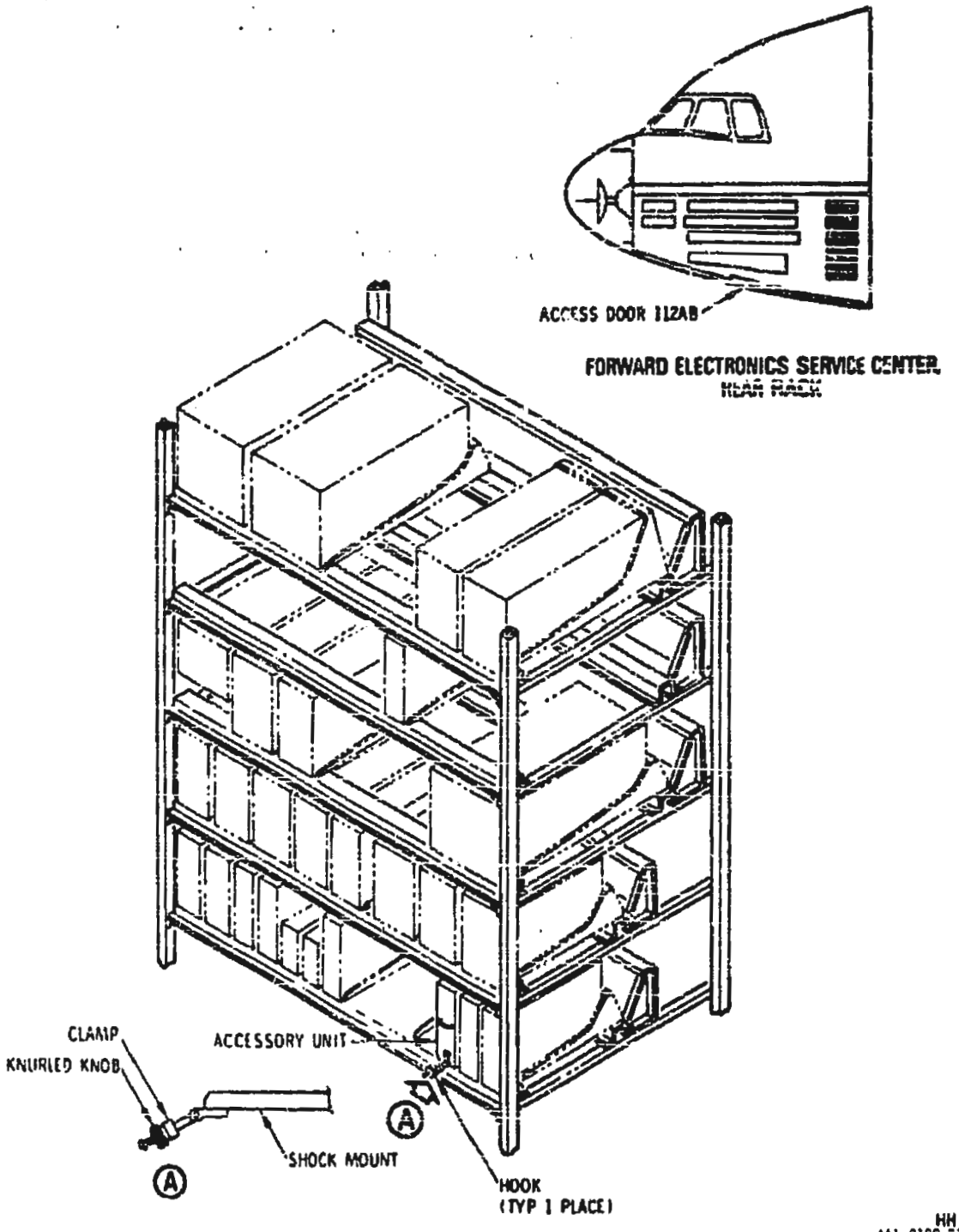
(3) Loosen and disengage knurled knobs securing accessory unit to mount.

(4) Pull accessory unit forward, disconnecting rear connector from mating mount connector. Remove accessory unit.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Position accessory unit, slide into place to mate with mount connectors.



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Heading Coupler Accessory Unit
Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

(3) Place mount clamps over accessory unit hooks.

(4) Tighten knurled knobs securing accessory unit to mount.

(5) Remove tags and close circuit breakers opened in Step 2A(1).

C (6) Perform operational test of heading coupler accessory
C unit as detailed in Paragraph C.

C C. Operational Check - Heading Coupler Accessory Unit

C NOTE: 1: For INS equipped aircraft, INS systems must be
C operating in ATT or NAV mode.

C 2: For INS adjustment/test see 34-43-00.

C 3: For flight director adjustment/test see 22-12-00.

C 4: For compass system adjustment/test see 34-22-00.

C (1) Ensure all circuit breakers for compass systems, flight
C director systems, and INS systems (if applicable) are
C closed.

C (2) Apply aircraft electrical power (Ref. 24-00-00) and
C activate essential and No. 2 radio buses.

C (3) Verify that compass cards in Capt's and F/O's HSI's and
C RDDMI's indicate approximately the same heading.

C NOTE: Compass headings may differ due to magnetic
C interference from nearby objects, structures,
C and iron in concrete under the aircraft.

C (4) On the APFDS engage panel, set flight directors A and B
C to on. Both ADI command bars should be in view and
C level and flags retracted.

C (5) On the Capt's compass controller, press the MAG/DG
C switch light and the DG legend comes on.

C (6) Using the set heading control, slew the Capt's compass
C CCW 30 degrees. The Capt's command bar should follow
C the heading change.

CR (7) On the autopilot Heading/Pitch mode panel, press the
CR "Heading" switch and on the the Capt's instrument
C source select panel, press the ALTN HDG switchlight.
C The ALTN HDG legend comes on, and the Capt's HSI card
C should agree with the F/O HSI card. The flight
C director command bar in the Capt's ADI should be level,

C equaling the position of the F/O ADI command bars.
C RDDMI compass cards should not move from their original
C positions before ALTN HDG was selected.

C (8) Press the ALTN HDG switchlight on the Capt's instrument
C source select panel. The ALTN HDG legend should go
C out, the Capt's HSI card and ADI command bar should
C indicate the original heading as in (6).

C (9) On the F/O instrument source select panel, press the
C ALTN HDG switchlight. The F/O HSI card and ADI command
C bar should all indicate the 30 degree change. RDDMI's
C should not change indication.

C (10) Press the F/O ALTN HDG switchlight and the ALTN HDG
C legend goes out. The F/O HSI heading and ADI command
C bar should now indicate aircraft heading and level.

C (11) On both compass controllers, press the MAG/DG
C switchlights. The MAG legend should appear, compass
C should synchronize, and the sync indicators be centered
C in 4 minutes.

C (12) Disengage both flight directors, turn INS mode panel
C switches to OFF. Remove aircraft power if it is no
C longer required.

C NOTE: Operation of flags is not noted in this test.
C See the appropriate system adjustment/test for
C flag operation information.

STANDBY MAGNETIC COMPASS - REMOVAL AND INSTALLATION

1. Referenced Procedure

   34-22-00 Magnetic Heading Reference System - Maintenance Practice Calibration

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 INSTRUMENT LIGHTS - STBY COMPASS (P8) circuit breaker.

      (2) Locate standby magnetic compass in bracket on center windshield frame in flight station, zone 210 (Ref. Fig. 401).

      (3) Remove screws securing standby magnetic compass to bracket.

      (4) Pull standby magnetic compass out of bracket, and disconnect connector from receptacle. Remove standby magnetic compass.

   B. Installation

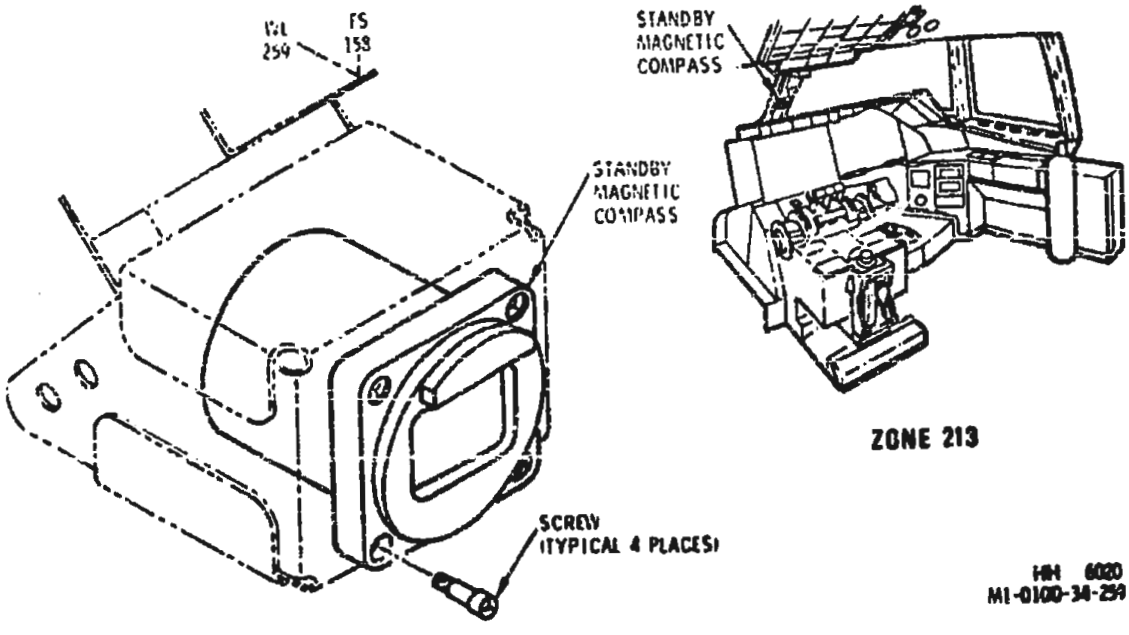
      (1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

      (2) Connect connector to receptacle on standby magnetic compass.

      (3) Place standby magnetic compass in bracket and secure with screws.

      (4) Remove tag and close circuit breaker opened in Step 2A(1).

      (5) Perform standby compass swing portion of magnetic heading reference system maintenance practice calibration (Ref. 34-22-00).



Standby Magnetic Compass - Removal and Installation
Figure 401

R AREA NAV ACCESSORY UNIT JUMPER PLUG - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 34-22-00 Magnetic Heading Reference System - Adjustment and
R Test

R 2. Removal and Installation

R A. Removal

R (1) On pilots overhead circuit breaker panel OB1, zone 210,
R open and tag the following circuit breakers:

R CAPT HSI (F3)

R CMPS COUPLER (G7)

R F/O HSI (F21)

R CMPS COUPLER (G25)

R CMPS CPLR-2 (J19)

R CMPS CPLR-1 (K19)

R (2) Open access door 112 AB and enter FESC. Locate area
R nav accessory unit jumper plug on rear rack, shelf 4,
R aft end. Locate and remove bolts securing jumper plug,
R remove jumper plug (Ref. Fig. 401).

R B. Installation

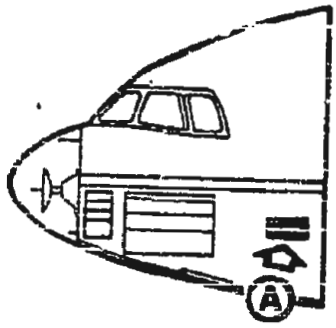
R (1) Verify that circuit breakers opened in Step 2A(1) are
R open and tagged.

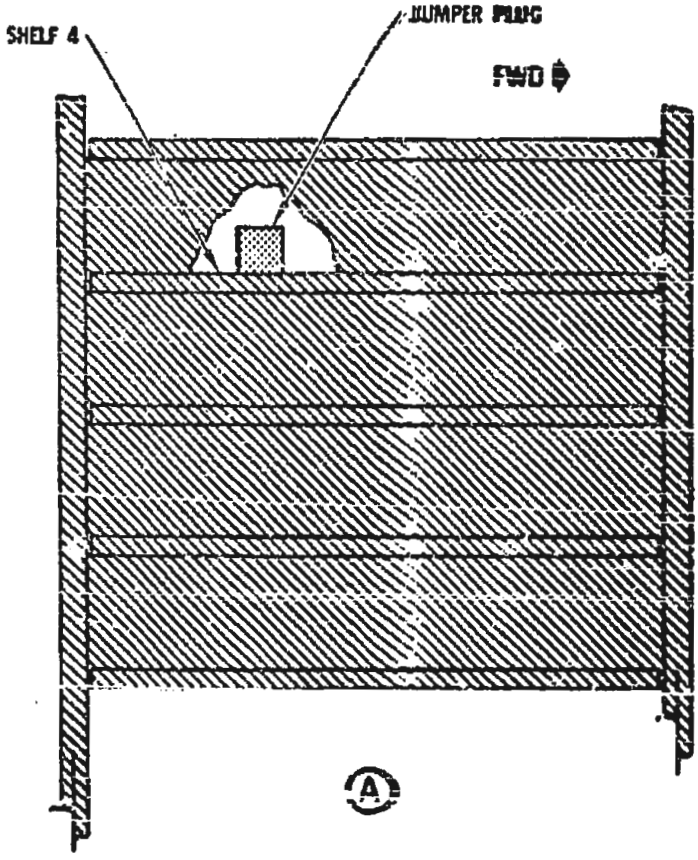
R (2) Insert area nav accessory unit jumper plug into
R accessory unit plugs at rear of rack.

R (3) Bolt and secure jumper plug using bolts removed in Step
R 2A(2).

R (4) Remove tags and close circuit breakers opened in Step
R 2A(1).

R (5) Perform Magnetic Heading Reference System adjustment
R and test (Ref. 34-22-00).





M1-0000-34-007

R Area Nav Accessory Unit Jumper Plug - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
0018

R

STANDBY HORIZON SYSTEM - DESCRIPTION AND OPERATION

1. Description

The standby horizon system consists of a standby horizon indicator which displays aircraft roll and pitch attitudes on an attitude sphere marked with a horizon line. The indicator is located on the center instrument panel (Ref. Fig. 1).

2. Operation

The standby horizon indicator operates from 115V ac, 400 Hz, single-phase primary power. Primary power is provided to the standby horizon indicator by the ac standby bus through the NO. 1 INSTRUMENT STBY HRZN IND (F6) circuit breaker on pilots overhead circuit breaker panel, C81.

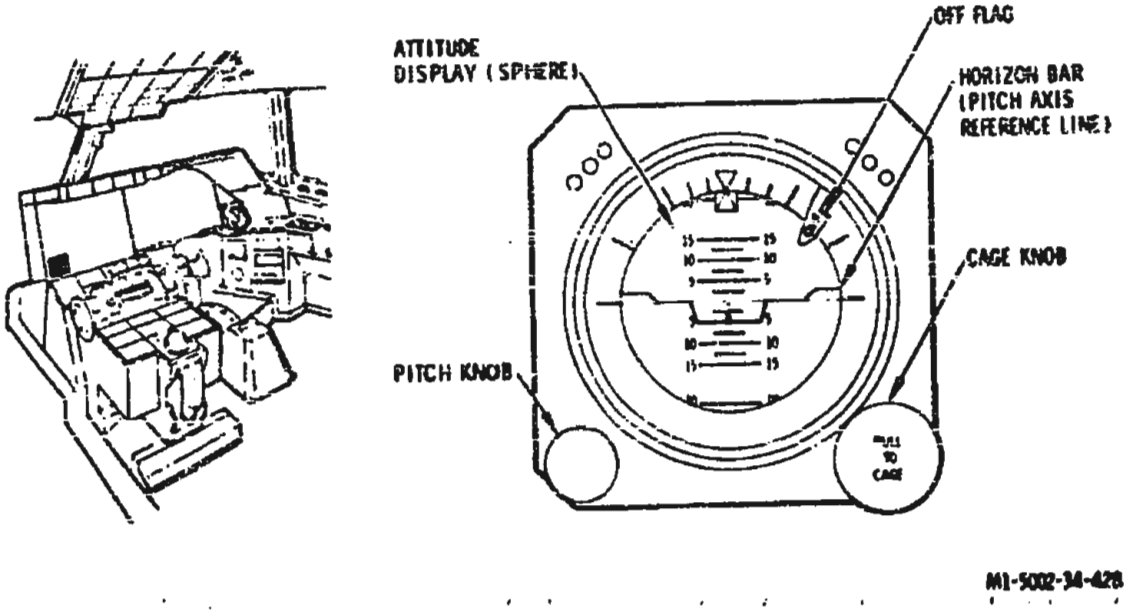
The allowable rotation of the attitude sphere is 85 ±1 degrees in each direction in the pitch axis and 360 degrees in the roll axis.

Roll angle is indicated by a triangular marker at the top of the standby horizon indicator. The triangular marker moves with the attitude sphere in the roll axis, and is read against a fixed scale.

A PULL TO CAGE knob is provided at the lower right corner of the standby horizon indicator for manual caging and gyro motor erection. At rest or spinning, the gyro motor is erected first about the roll axis and then about the pitch axis.

A pitch knob is provided at the lower left corner of the standby horizon indicator to allow changing the pitch axis reference line. The pitch axis reference line is moveable 11 degrees down (dive) and 5 degrees up (climb).

The standby horizon indicator is provided with a power warning OFF flag that remains out of view during normal operation. Loss of, or reduction of primary power (below 75.7V ac) causes the OFF warning flag to come into view at the upper right corner of the standby attitude indicator.



R
R

Standby Horizon Indicator
Figure 1

STANDBY HORIZON SYSTEM - TROUBLESHOOTING

1. General

A. Standby horizon indicator malfunctions occur in two general areas -- indicator sphere OFF-LEVEL problems or OFF flag problems. Each of these problems should be verified by trouble shooting to assure that an actual malfunction does exist. Normally, replacement of the indicator will correct the standby horizon malfunction.

B. The operating tolerances for the standby horizon system vary with the operating regime, on the ground or during flight. The standby horizon indicator is compared with the captain's attitude indicator for accuracy during ground and flight regimes using the tolerances shown below:

	Ground Tolerances	Flight Tolerances
Roll	Within 3 degrees five minutes after caging.	Within 4 degrees less than 6 minutes after return to level flight.
Pitch	Within 2 degrees five minutes after caging.	Within 4 degrees less than 7 minutes after return to level flight.

When the ground check is performed, the indicator power must have been applied for three minutes before caging the indicator.

C. The indicator incorporates a "roll brake" that engages when power is removed from the indicator. This roll brake is also associated with the OFF flag in-view stop. When power is first applied to the indicator, the spin-up gyro wobble often increases tension on the flag in-view stop causing the flag to remain in view. Such flag hang-ups can be prevented by briefly extending the PULL-TO-CAGE knob to relieve this tension.

D. The indicator has no self-erection system (such as on vertical gyros) when power is first applied. For this reason the PULL-TO-CAGE knob must be pulled to level (cage) the horizon display. This can be done approximately three minutes after power is applied. After caging the horizon, the internal mechanical erection system will maintain the horizon level within the above stated tolerances.

C E. To assure proper operation of the standby horizon system,
C perform the standby horizon indicator - adjustment/test
C (Ref. 34-23-00, Page 501).

2. SIGMA DATA Reporting

A. SIGnificiant MAintenance DATA format for the standby horizon indicator is rubber-stamped on the M215 tag attached to each indicator.

B. The SIGMA DATA reporting is designed to provide the following benefits:

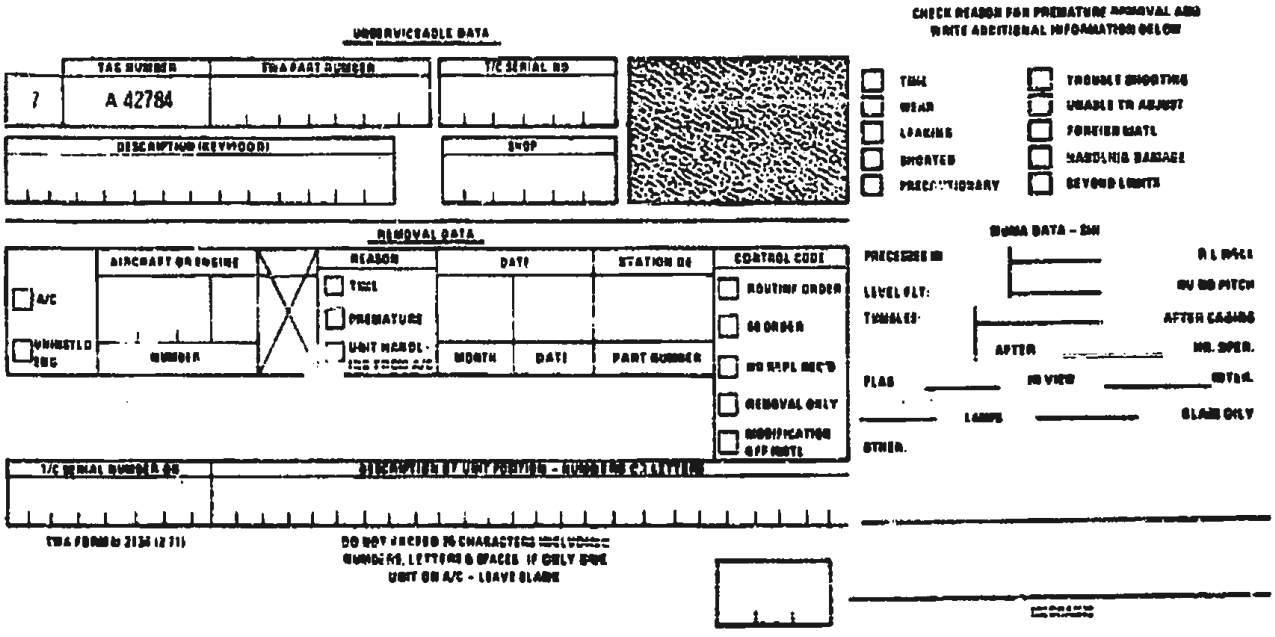
(1) Allow easier completion of the M215 tag

(2) Provide significiant information to the MCI shop mechanic

(3) Provide a guide for aircraft troubleshooting

C. Each item of the SIGMA DATA format is significiant to the MCI shop mechanic as he troubleshoots the indicator. He can begin in the problem area rather that checking several areas for an undefined problem. This will reduce MCI shop repair time and allow quicker turnaround of indicators to your station.

D. Shown in Figure 101 is the SIGMA DATA format that will appear on the M-215 tag attached to the Standby Horizon Indicators (P&R 31306).



MI-0000-34-3663

Sigma Data Tag
Figure 101 (Sheet 1)

EFFECTIVITY: ALL

E. The following is a description of each item of the SIGMA DATA format:

(1) PRECESSES IN LEVEL FLIGHT: _____° R L ROLL
_____° NU ND PITCH

On the line write in the number of degrees and circle the direction that the indicator precesses in level flight. For example:

5 ° R (L) ROLL for five degrees left roll.

Another example:

4 ° (NU) ND PITCH for four degrees nose up pitch.

(2) TUMBLES: _____ AFTER CAGING

AFTER _____ HR. OPER.

Check (✓) AFTER CAGING when the indicator tumbles after the PULL-TO-CAGE knob is released with power applied or write in the time (in hours) after caging that the indicator tumbles (if applicable).

Example: ✓ AFTER CAGING OR AFTER 1/2 HR. OPER.

(3) FLAG: _____ IN VIEW _____ INTER.

Check (✓) if the indicator OFF flag is in view or if it is intermittently (INTER.) in and out of view.

NOTE: An OFF flag in view can be caused by lack of aircraft power if the OFF flag is in view and the gyro will not remain erect after releasing the PULL-TO-CAGE knob with power applied.

(4) _____ LAMPS _____ GLASS OILY

Check (✓) if lamps are not lighted or if the indicator glass squawked as oily.

NOTE: Do not remove an indicator for oily glass unless squawked by the flight crew or indicator visibility is seriously limited by oil film.

(5) OTHER:

Record all other malfunctions that were determined during trouble-shooting or from the aircraft log.

STANDBY HORIZON INDICATOR - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00	Air conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
34-23-01	Standby Horizon Indicator - Removal and Installation

2. Adjustment/Test

A. Preparation

(1) Ensure the following circuit breakers on pilots overhead circuit breaker panel CB1 are engaged:

VG/INS 1 (G6) STBY HRZN IND (F6)

STBY HRZN LT (F7)

3VAC STBY HORIZ LT (J27)

CR CAPT ADI (F2)

CR INSTR COMPRN MON PWR (D8)

(2) Ensure circuit breaker CTR L (L22) on FE/SO overhead circuit breaker panel CB2 is engaged.

(3) Ensure the following circuit breakers on FE/SO aft circuit breaker panel CB3 are engaged:

STBY LT RELAY (J11)

CTR INSTR & GLARE SHLD (J13)

(4) Turn on aircraft electrical power (Ref. 24-00-00).

(5) Verify equipment cooling is on (Ref. 21-20-00).

(6) Verify Captains ALTN-ATT switchlight is out. If on, press and release to extinguish ALTN legend.

(7) After 5 minutes, verify ATT flag on Captains attitude director indicator (ADI) located on Captains instrument panel is out of view.

NOTE: Presence of other flags will not effect test.

(8) Check that Captains attitude display aligns to level indices ±2 degrees. If ADI attitude display is displaced greater than 2 degrees from level indices, check aircraft attitude for agreement with ADI attitude display. If required, level aircraft within 2 degrees (Ref. 8-10-00).

R CAUTION: WHENEVER IT IS NECESSARY TO REMOVE ELECTRICAL POWER FROM VERTICAL GYRO FOR 90 SECONDS OR MORE, POWER SHOULD REMAIN OFF FOR AT LEAST TEN MINUTES TO ASSURE PROPER ERECTION OF GYRO UPON REAPPLICATION OF POWER.

B. Operational Test

(1) Check that standby horizon indicator OFF flag is out of view.

(2) Open and tag circuit breaker STBY HRZN IND (F6).

(a) OFF flag comes into view. Wait 3 minutes before proceeding to Step (3).

(3) Remove tag and close circuit breaker STBY HRZN IND (F6).

(a) OFF flag is out of view. Wait 3 minutes before proceeding to Step (4).

NOTE: Sphere may wobble after circuit breaker is initially closed.

(4) Pull standby horizon indicator PULL-TO-CAGE knob to
R erect sphere display to indicate 0 degree pitch and
R roll attitude. While pulling caging knob, adjust pitch
R horizontal reference bar to cover sphere horizon line
R (0 degree pitch attitude) using pitch knob. Release
CR PULL-TO-CAGE knob and wait 5 minutes before proceeding to Step (5).

NOTE: Maintain this eye level position for check during Step (5).

(5) Check that standby horizon indicator sphere display indicates within 2 degrees of aircraft pitch attitude and within 3 degrees of aircraft roll attitude as displayed on Captains ADI.

(6) On center console; rotate ENGINE INSTR control CW from OFF to BRT, then CCW back to OFF.

(a) As control is rotated CW, standby horizon indicator integral lights come on and brighten. As control is rotated CCW, integral lights dim and then go out.

(7) On FE/SO aft circuit breaker panel CB3, disengage circuit breaker STBY LT RELAY (J11).

(a) Standby horizon indicator integral lights come on at approximately one-half brightness.

NOTE: ENGINE INSTR control provides no control of integral light intensity with STBY LT RELAY (J11) circuit breaker disengaged.

(8) On FE/SO aft circuit breaker panel CB3, engage circuit breaker STBY LT RELAY (J11).

C. Shutdown

(1) Turn off aircraft electrical power (Ref. 24-00-00).

STANDBY HORIZON INDICATOR - REMOVAL AND INSTALLATION

1. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 INSTRUMENT STBY HRZN IND (F6), LT (F7), 3VAC STBY HORIZ LT (J27) and 5VAC INSTRUMENT LIGHTING CTR L (L22).

CR CAUTION: ALLOW 5 MINUTES FOR GYROS TO RUN DOWN BEFORE REMOVING
CR UNIT OR GIMBAL DAMAGE MAY RESULT. USE CARE DURING
CR REMOVAL TO PREVENT DAMAGE TO AIRFLOW SEAL. UNIT
CR SHOULD BE TRANSPORTED IN ITS SHIPPING CONTAINER AT ALL
CR TIMES.

(2) Locate standby horizon indicator on pilots center instrument panel, zone 210 (Ref. Fig. 401).

(3) Loosen clamp screws securing standby horizon indicator to pilots center instrument panel.

(4) Pull standby horizon indicator out of recess in panel and disconnect connector from receptacle.

C CAUTION 1: DRAW INDICATOR OUT OF INSTRUMENT PANEL WITH
C CARE TO AVOID STRESS AND INJURY TO ELECTRICAL HARNESS.

B. Installation

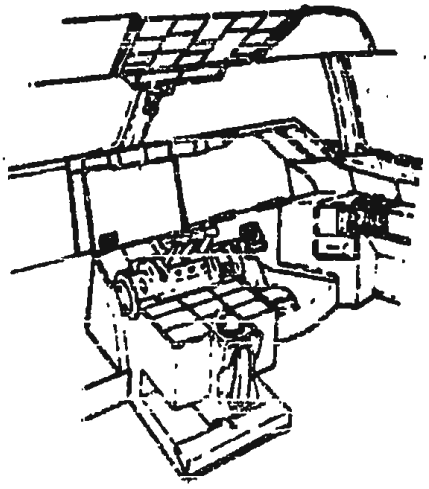
C (1) DELETED.

(2) Verify that circuit breakers opened in Step A(1) are open and tagged.

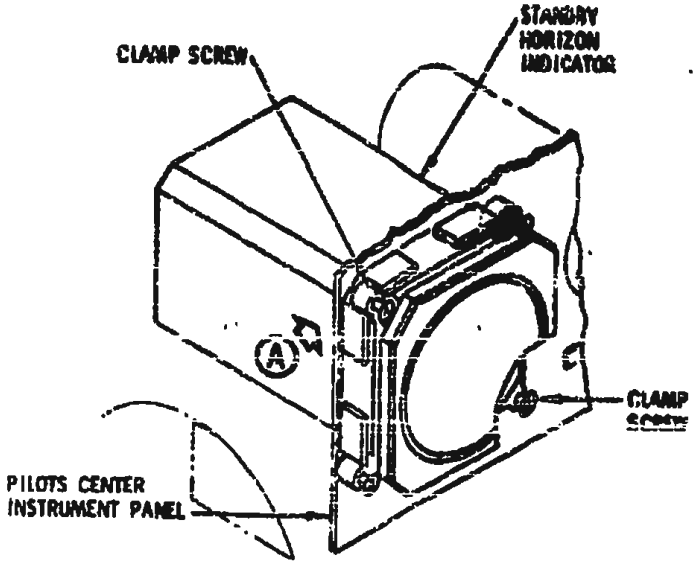
(3) Connect aircraft harness connector (3421-P10) to indicator connector.

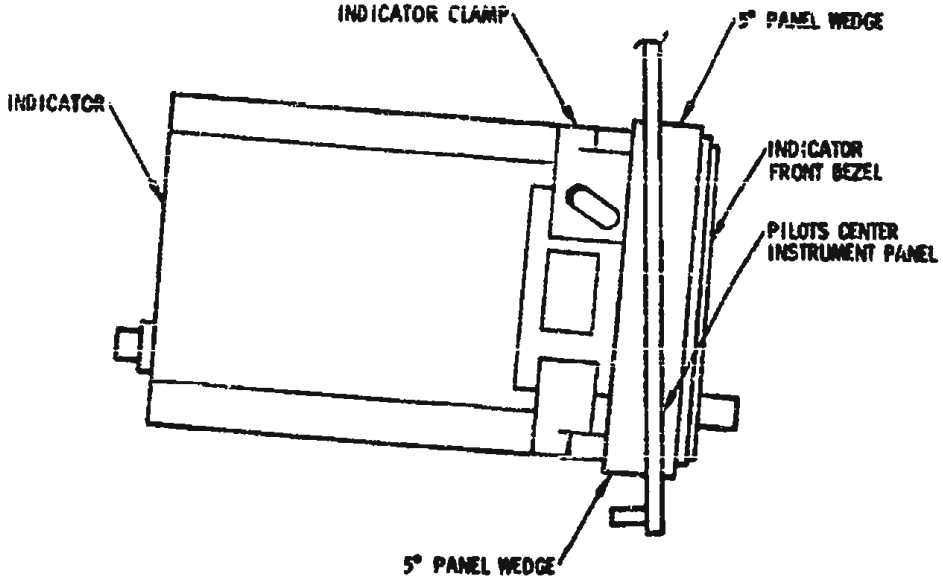
(3) Position standby horizon indicator in recess on pilots center instrument panel, slide into position, and secure by tightening clamp screws. Check indicator for secure mounting by pulling PULL-TO-CAGE knob. Tighten screws as necessary to properly secure indicator. Check that instrument wedges are installed properly (Figure 401, view A).

(4) Remove tags and close circuit breakers opened in Step A(1).



ZONE 210





M1-5000-34-427

R Standby Horizon Indicator Installation
R Figure 401

R EFFECTIVITY: ALL
R
050B

(5) Perform standby horizon indicator adjustment and test procedure (Ref. 34-23-00).

LANDING AND TAXIING AIDS - DESCRIPTION AND OPERATION

1. General

The landing and taxiing aids are that portion of the navigation system which provides guidance during approach, landing, and taxiing. The landing and taxiing aids consist of the following systems and components:

Radio altimeter system (Ref. 34-32-00):

Radio altitude indicator

Instrument landing system (ILS) (Ref. 34-33-00):

Horizontal situation indicator (HSI)

Attitude director indicator (ADI)

Marker beacon system (Ref. 34-35-00):

Marker beacon indicator light assembly

R Ground proximity warning system (Ref. 34-45-00):

R GPWS computer

R Warning panel

R Warning lights

The radio altimeter system interfaces with the following systems: autoflight (AFCS) (Ref. 22-00-00), attitude director indicator (ADI) (Ref. 34-21-00), audio integrating (Ref.
R 23-51-00), ground proximity warning system (Ref. 34-45-00), and the aircraft integrated data system (AIDS) (Ref. 31-32-00).

R The instrument landing system interfaces with the following
R systems:autoflight, ground proximity warning system, and aircraft integrated data system.

The marker beacon system interfaces with the audio integrating system (Ref. 23-51-00) and the aircraft integrated data system.

R The ground proximity warning system interfaces with the radio
R altimeter, ADC, ILS systems; and landing gear and flap switches.

RADIO ALTIMETER SYSTEM - DESCRIPTION AND OPERATION

1. General

The radio altimeter system provides true altitude above terrain outputs and readouts during the approach, landing, and climb-out phases of aircraft operation. Range of the equipment is 2500-feet to touchdown.

The aircraft has two identical radio altimeter systems. Each system (Ref. Fig. 1) consists of a receiver-transmitter (RT), a radio altitude indicator and four identical antennas.

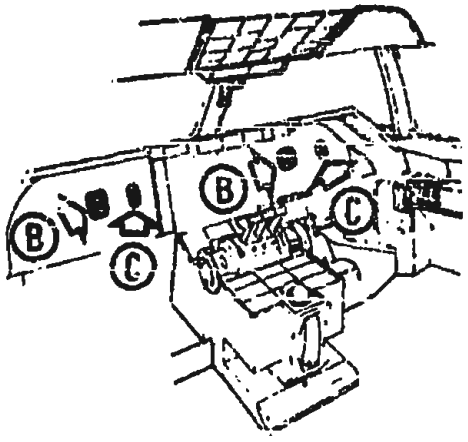
The RT units are housed in a standard ARINC 1/2-ATR short case and located in the mid electrical service center zone 137: No. 1 in the left rack and No. 2 in the right rack. The indicators are located, one each, on the Captains and First Officers instrument panels, zones 211 and 212. The antennas are flush mounted on the bottom of the fuselage in the wing butt area, zone 142.

The RT is a solid state, frequency modulated, continuous wave unit operating in the frequency range of 4250- to 4350-MHz. The receiver-transmitter (RT) provides a dc analog voltage which represents true aircraft altitude above the terrain. This output is applied to the radio altitude indicator to provide a visual indication of aircraft altitude from 2500-feet to touchdown. An additional dc analog output is provided for the AFCS.

The 860F-1 RT unit front panel contains the following fault indicators: RT, VSWR, IND, and X-CONN. In addition, a RESET switch, a SELF-TEST switch, and a TEST connector are provided. The rear panel contains a dual electrical connector for system interface and connection to the dual antennas.

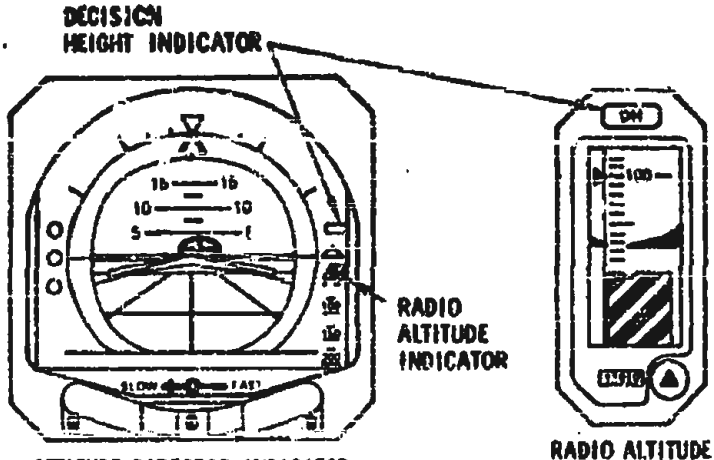
The 860F-4 RT unit front panel contains a TEST/STATUS switch/lamp combination and a TEST connector. The rear panel contains a dual electrical connector for system interface and connection to the dual antennas.

R Radio Altimeter System No. 1 (Ref. Fig. 2) drives the captains radio altitude indicator, and provides inputs for
R No. 1 pitch, roll, and yaw computers and the Captains attitude director indicator altitude indicationIt also provides radio altitude and validity signals to the GPWS (Ref. 34-45-00). Radio Altimeter System No. 2 drives the First Officers radio altitude indicators, and provides inputs for No. 2 pitch, roll, and yaw computers and the First Officers attitude director indicator radio altitude



PILOTS INSTRUMENT PANELS

(A)

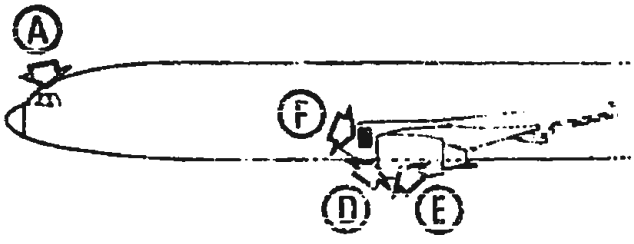


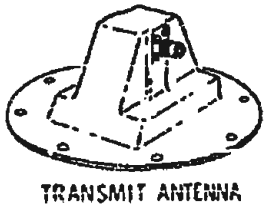
ATTITUDE DIRECTOR INDICATOR

(B)

RADIO ALTITUDE
INDICATOR

(C)



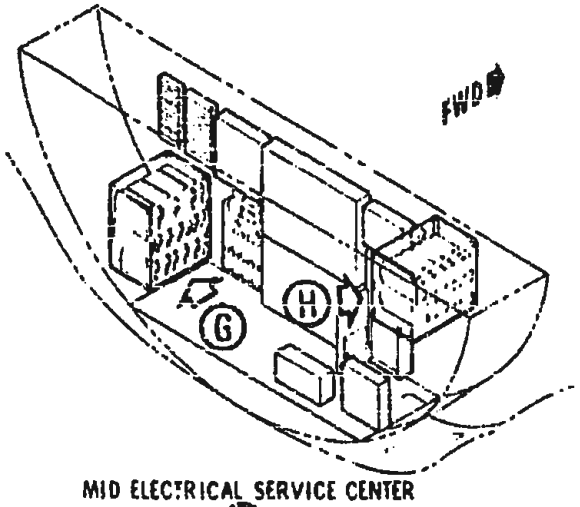


TRANSMIT ANTENNA
NO. 1 (LEFT)
NO. 2 (RIGHT)

(D)

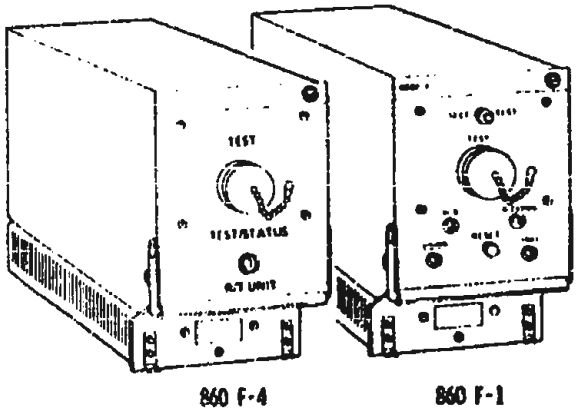
RECEIVE ANTENNA
NO. 1 (LEFT)
NO. 2 (RIGHT)

(E)



MID ELECTRICAL SERVICE CENTER

(F)



860 F-4
(DIGITAL)

860 F-1
(ANALOG)

TRANSMITTER/RECEIVER

(G) NO. 1 (H) NO. 2

M1-0003-34-094

R
R

Radio Altimeter System
Figure 1

indication. Both systems generate a decision height (DH) visual and audio warning from their respective indicators. Radio altitude signals are also supplied to the aircraft integrated data system (AIDS - Ref. 31-32-00).

Each radio altimeter system provides six altitude trip outputs. One output (200-foot trip) is used to enable the radio altitude indicator in the ADI (Ref. 34-21-00).

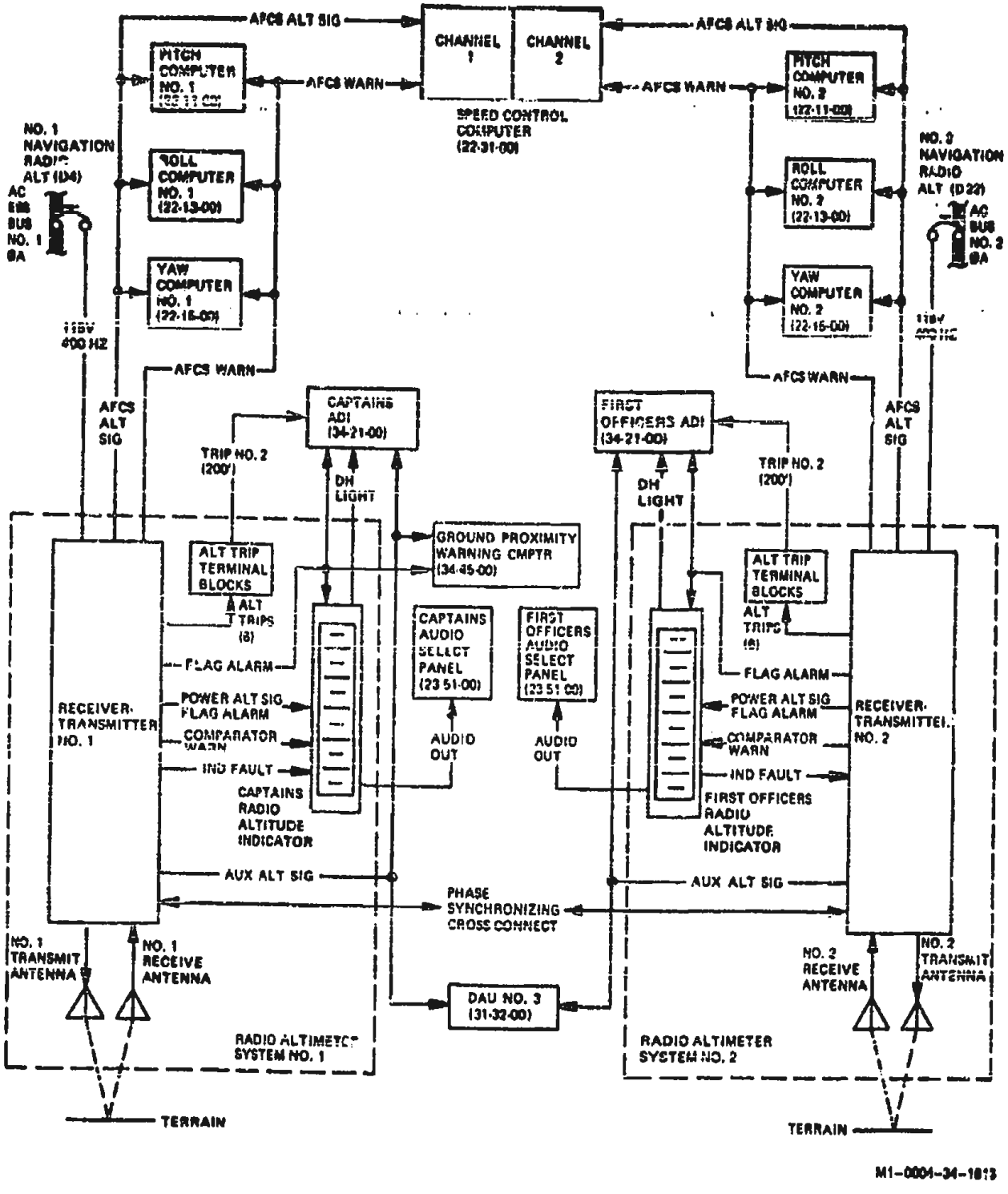
Terminal blocks are provided for connection of the RT altitude trips to other aircraft equipment. These terminal blocks are part of the terminal block module assemblies, which are located outboard of the associated RT. Each of the six altitude trip outputs from each RT is connected to a separate block and may be connected as required.

NOTE: The 860F-1 analog RT unit is no longer being manufactured, consequently it is possible for an 860F-4 digital RT unit to show up in your fleet. These are directly interchangeable. The following description and operation will cover both units.

The frequency of the transmit signal is continuously varied from 4250- to 4350-MHz and back to 4250-MHz at a rate of 100-times per second. Since radio waves travel at a finite velocity, it will require a finite time for a wave to travel a given
R distance. Referring to Figure 3 (detail A), consider transmitted signal frequency F1 at time T1. This signal is received as a reflected wave after time interval delta T. However, during this interval, the transmitted signal has increased in frequency to new frequency F2. The difference between this new transmitted frequency signal, F2, and the received reflected signal frequency will therefore depend on the distance (altitude) the signal has traveled. By means of proper calibration, this difference in frequencies is electronically and mechanically converted into a visual indication of altitude.

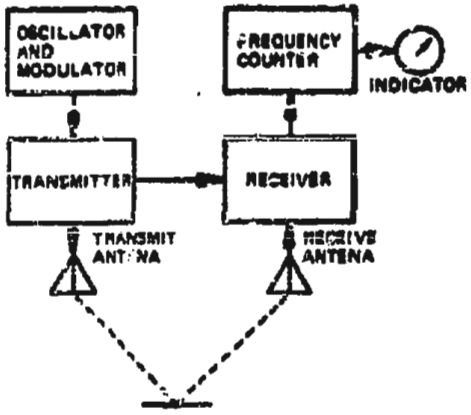
During the time the transmit signal frequency is increasing, the receive frequency will be less than the transmit frequency. During the time the transmit frequency is decreasing, the receive frequency will be greater than the transmit frequency. For a given altitude, however, the numerical value (disregarding sign) of the frequency difference in both cases will be the same, since travel time delta T is the same.

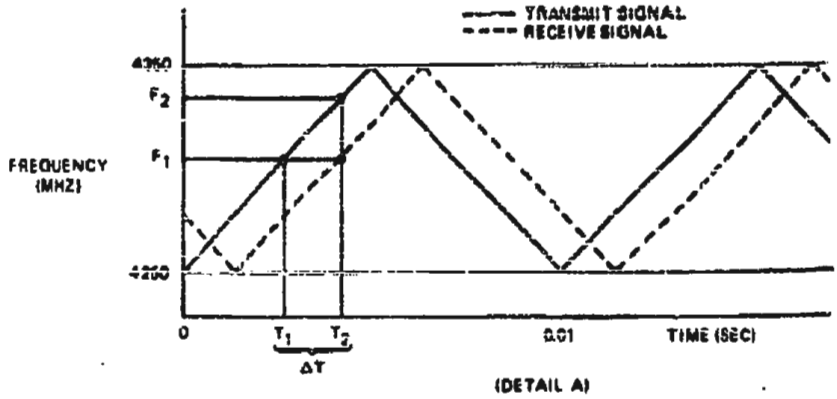
NOTE: A small time period exists during which frequency difference is not constant with altitude. As indicated in Figure 3 (detail B), during each rise and fall in frequency of the transmit and receive signals there occur two turnaround modulation time periods. In the Figure, the relative value of turnaround time as compared to operational time is exaggerated for descriptive purposes.



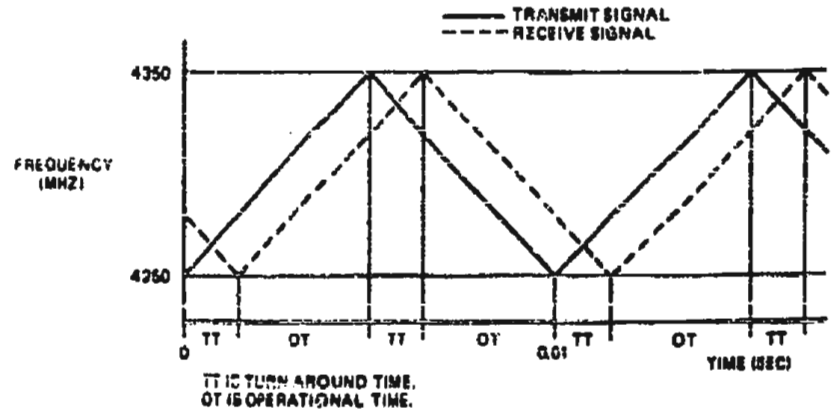
R R Radio Altimeter System Block Diagram
Figure 2

EFFECTIVITY: ALL





(DETAIL A)



(DETAIL B)

M1-0001-34-022

Radio Altimeter Operation Graph
Figure 3

Vital system functions in the RT are monitored during operation. A detected fault results in a radio altitude indicator warning flag, an AFCS warning, and the tripping of one or more maintenance fault indicators on 860F-1 RT units, or the single fault indicator on 860F-4 RT units located on the RT front panel. The monitor circuits are disabled during self test.

The radio altimeter system is a dual system with both RT units operating on the same frequency. To minimize interference between two 860F-1 RT units, the oscillator-modulators are synchronized and operated at 180-degrees out of phase. System No. 1 operates at 0-degrees and System No. 2 operates at 180-degrees. Phasing and synchronization is obtained by cross-connecting the oscillator-modulators in both RT units. Thus each transmitter is modulated at the same frequency, but in opposite phase. The cross-connect lines also monitor whether the out of phase condition is being maintained. If not, a X-CONN fault annunciator on the RT front panel will turn to a yellow indication.

In order to prevent interference between two 860F-4 RT units, the phase of the modulation must be adjusted when mutual interference is detected. The mixer signal from the receiver is routed through a high-pass filter to a mutual interference detector, which contains a threat comparator. When two altimeters approach modulation phase alignment, the threat detector is activated and causes a binary addition to the up/down counter in the modulator. The number added to the count is dependent on a strap connection on the rear panel connector. These strap connections are different for the several units in a multiple installation so the phase adjustments do not coincide. Once out of phase, considerable time elapses before they merge again, effectively preventing mutual interference.

Radio altimeter system No. 1 is powered by the ac essential bus, phase A, through the NO. 1 NAVIGATION RADIO ALTM (D4) circuit breaker. System No. 2 is powered by the No. 2 ac extension bus, phase B, through the NO. 2 NAVIGATION RADIO ALTM (D22) circuit breaker on the pilots overhead circuit breaker panel CB1, zone 210.

NOTE: Because of change in attitude, gear compression and system tolerances, radio altimeter readings after touchdown and while on the ground could vary between 0- and minus 10-feet.

2. 860F-1 Receiver-Transmitter (RT)

A. Description

(1) Transmitter and Chassis Circuits

(a) Transmitter

The transmitter circuits are contained in the fin-cooled lower section of the RT. The circuits consist of a frequency modulated (FM) oscillator followed by several amplifier and frequency-multiplier stages. The final three stages consist of a varactor-multiplier chain which multiplies the frequency to the required output of 4300 (±50)-MHz.

(b) Mixer

The mixer assembly contains the microwave portion of the RT. The mixer assembly includes a hybrid ring-balanced mixer, a bandpass filter in the receiver input line, and a directional coupler. A portion of the transmit signal is mixed with the receive signal to produce a beat frequency which is a function of aircraft altitude.

(c) Circulators, Delay Line, and Attenuators

The transmit and receive circulators are magnetic switching devices. The magnetic properties of the ferrite rings are such that a bias current reverses the signal path through the ring.

In transmitting, with no bias current applied, the signal is directed from the input port to the transmit antenna output port. In receive, the signal is directed from the antenna input port to the mixer port.

In transmitting, with bias current applied, the signal is directed from the input port to the delay line output port. In receiving, the signal is directed from the delay line input port to the mixer output port.

The delay line and attenuators are selected circuit elements providing special time delay and attenuation characteristics. These elements are used to simulate a 30 ± 3-foot aircraft altitude for self-test.

(2) Receiver and Monitor Circuits

(a) Monitor Module

The monitor module consists of VSWR (voltage standing wave ratio), R/T, indicator fault

circuits, a circulator current monitor, and a modulation monitor.

The modulation monitor is a frequency-sensitive detector circuit that monitors the transmitter FM rate. A warn output is provided when the modulation rate exceeds preset limits.

The VSWR monitor is a level-sensitive detector circuit that monitors transmitter power output, receiver gain, and antenna/antenna cables operational condition. A warn output is provided when the VSWR level is higher or lower than a preset level. The VSWR monitor operates only above 2500-feet.

NOTE: In later model units, the VSWR monitor checks for low, closed loop gain and high VSWR in RF circuits.

The fault indicator logic circuits consist of four separate fault monitor circuits, VSWR, RT, IND, and X-CONN. If a failure occurs in the radio altimeter system, these circuits provide an output to the associated fault indicator on the front panel of the RT.

(b) Preamp and Tracking Filter Module

The preamp and tracking filter module consists of a preamplifier stage and three filter networks. The low frequency response of the preamp is controlled by a high-pass switch. The filters provide tracking capabilities. An AGC circuit controls the gain of the three filter networks.

(c) Terminal Board No. 1

The circuits on TB1 consists of a signal presence monitor, a 115-kHz monitor, a trigger amplifier, an off-scale oscillator, a pulse generator module, a pointer stow multivibrator module, a time domain filter, a filter monitor, frequency counters No. 1 and No. 2, gain shapers No. 1 and No. 2, and operational amplifiers No. 1 and No. 2.

(d) Terminal Board No. 2

The TB2 circuits consist of a comparator warning circuit, an AGC failsafe monitor, a logic pulse amplifier, six altitude trip detector circuits, a

flag logic circuit, a modulator, and a cross connect monitor.

(e) Terminal Board No. 3

The TB3 assembly consists of the autopilot warn relay, self test, altitude bias network, and aircraft installation delay (AID) bias circuits.

(3) Power Supply

The power supply module contains the circuits necessary to convert the 115-V ac, 400-Hz primary power to the various ac and dc voltages required for operation of the radio altimeter system.

B. Operation

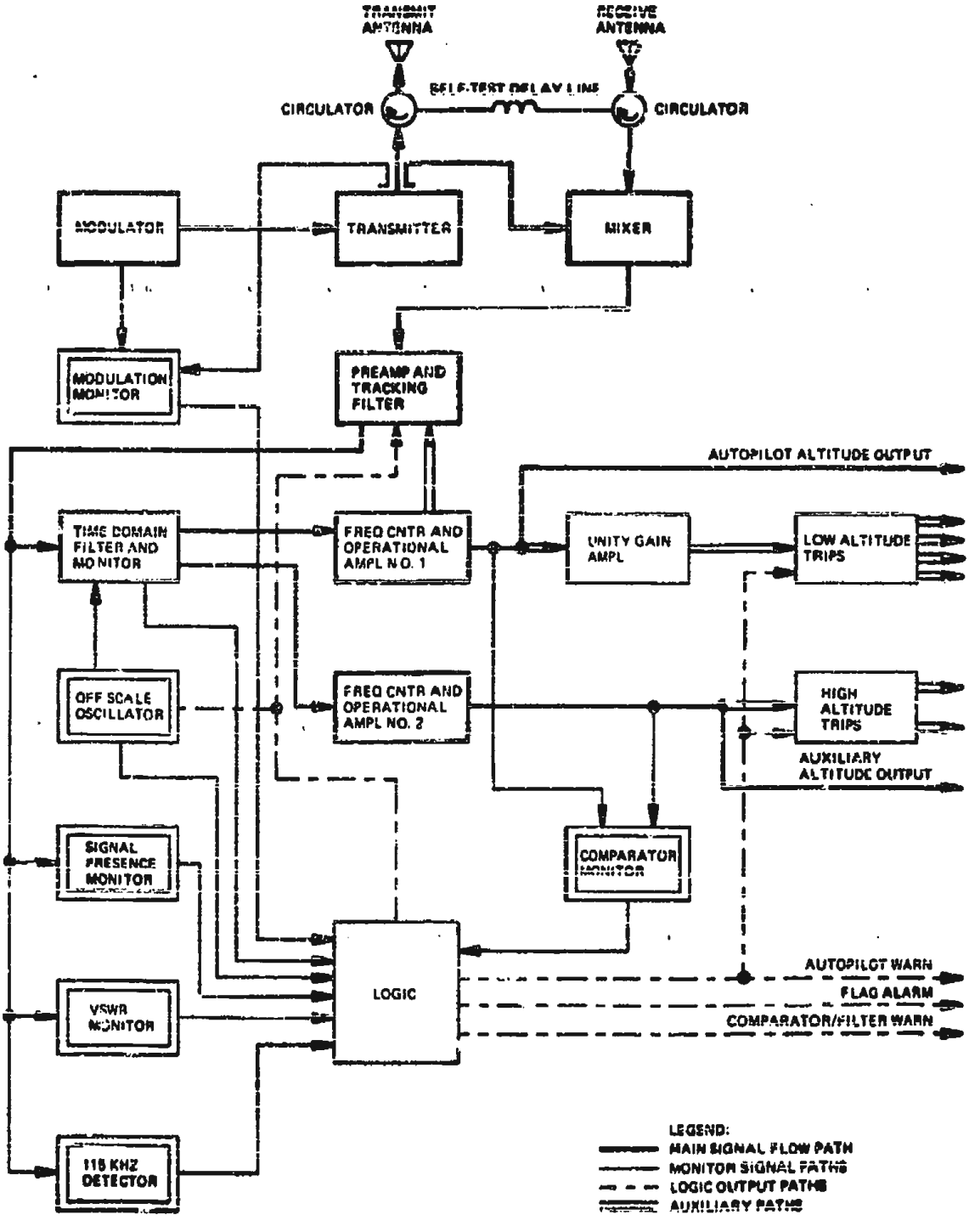
(1) General

The RT has three modes of operation. Mode I occurs under normal operating conditions at altitudes below 2500-feet. Mode II occurs at altitudes above 2500-feet. Two internally generated signals maintain the operational condition to permit monitoring. Mode III is a system self-test. Mode I and Mode II are automatic functions dependent upon altitude and related variable parameters which include operational condition, terrain reflection characteristics, and atmospheric conditions. Because of these parameters, the transition from Mode I to Mode II may extend through an altitude variation as great as 1000-feet.

(2) Modulator and Transmitter

The modulator generates a 100-Hz signal used to frequency modulate the transmitter oscillator. A small portion of the modulator output is applied to the modulation monitor. Provision is made to phase-lock 2 or 3 oscillators in a multisystem installation and select a 0-, 120-, or 240-degree phase shift at the modulator output. This ensures a non-interference in multisystem installations. The transmitter output originates in a 67.2-MHz oscillator (frequency modulated by the 100-Hz modulator). After multiplication by a factor of 64, and amplification, the output is a 4300 (±50)-MHz frequency modulated signal applied to the transmit antenna through a magnetic circulator.

(3) Circulator and Mixer

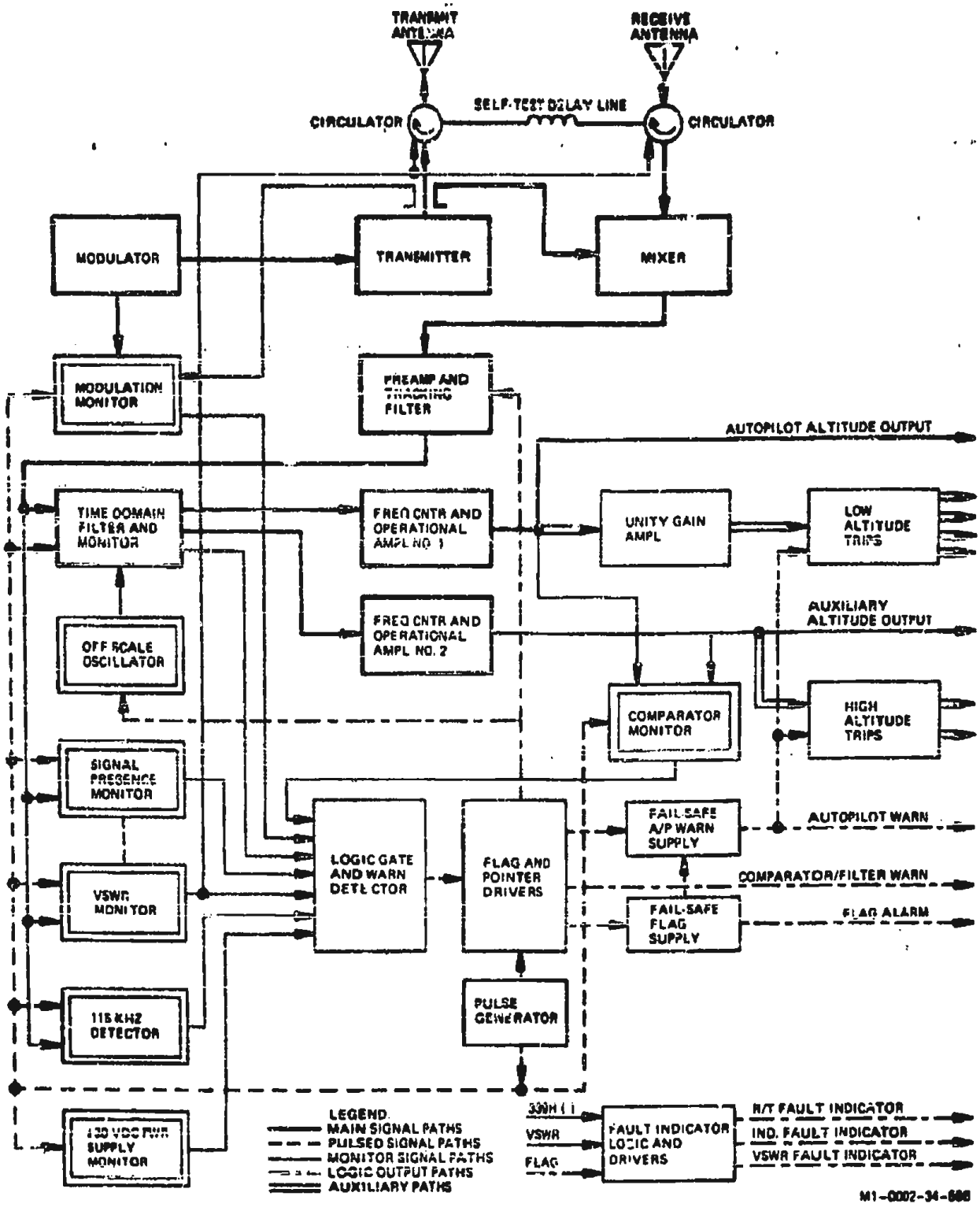


M1-0001-34-380

R 860F-1 Receiver - Transmitter Block Diagram
R Figure 4

EFFECTIVITY: SERIAL NO. 3999 AND BELOW

001B



R R 860F-1 Receiver - Transmitter Block Diagram
Figure 4

EFFECTIVITY: SERIAL NO. 4000 AND ABOVE

Both circulators are magnetic switching devices used to provide directional control of both transmit and receive signals.

In Mode III (self-test), the transmit signal is diverted from the Mode I and II antenna output port to the self-test, delay-line port. In the delay line, the transmit signal is delayed and attenuated to accurately simulate a predetermined altitude return signal.

When using the late model monitor module, in Mode I the signal path in the receive circulator is from the receive antenna port to the mixer output port. In Mode II, the circulators are switched every 4-seconds to provide loop gain and VSWR checks by the VSWR monitor.

When using the early model monitor module, the Mode I and II signal path in the receive circulator is from the receive antenna port to the mixer port. In Mode III, the circulator is switched to receive the delay-line signal, but the output port remains unchanged.

In all modes, the signal from the receive circulator is mixed with a portion of the transmitter output to produce a difference frequency. This frequency is a function of the delay between transmit and receive.

(4) Preamp and Tracking Filter Module

The preamp and tracking filter provides signal amplification and tracking capabilities. In Mode I (up to approximately 300-feet in altitude), Mode II, and Mode III, the preamplifier low-frequency response is increased to make it more responsive to low altitude frequencies. In Mode I (above 300-feet), the response to low frequencies is reduced to improve high-frequency tracking capabilities. The low-frequency response is increased in Mode II to allow signal capture of low-frequency signals.

(5) Time Domain Filter and Monitor

The time domain filter and monitor receives input signals from the preamp and tracking filter. The time domain filter improves tracking capabilities by preventing response to undesirable altitude signals producing frequencies between 1.67 and 2.1 times the tracking frequency. These conditions can exist, when due to highly reflective terrain, the transmit signal apparently makes two round trips between aircraft and terrain. The monitor circuit provides a fixed time

delay to hold the receiver at the tracking frequency for approximately 0.5-second. If the higher frequency is still present after this time delay, the monitor circuit causes the receiver to begin tracking the higher frequency. The monitor circuit also continually monitors the operation of the low-pass filter. If any failure occurs in the low-pass filter, the monitor provides a logic zero warn output to the logic matrix. The monitor also provides logic zero output to the matrix in mode III.

(6) Frequency Counters, Operational Amplifiers, and Gain-Shaping Networks

Two networks, consisting of a frequency counter, operational amplifier, and gain-shaping network, provide two altitude output voltages from the receiver-transmitter.

Each frequency counter supplies a pulsed output to the associated operational amplifier, each operational amplifier integrates the pulsed input to provide a dc analog output voltage.

The gain-shaping networks (not shown on Figure 4) establish relationship between altitude frequency and the analog voltage level above approximately 480-feet. Below approximately 480-feet, the relationship between altitude frequency and analog voltage is linear. Above 480-feet, the gain-shaping network establishes a logarithmic relationship.

(a) Modulation Monitor

The modulation monitor, monitors the transmitter modulation level. A significant change in modulation level results in a warn (logic zero) output to the logic matrix. In Mode III, the test input causes the modulation monitor to provide logic zero output to the logic matrix.

(b) Signal Presence Monitor

The signal presence monitor, monitors the return signal strength. When the level decreases below 200-mv (normally occurs in the transitional period between Mode I and Mode II), the circuit provides a warn output to the logic matrix. For late model monitor modules, the warn output also triggers the VSWR monitor.

(c) 115-kHz Detector

The 115-kHz detector indicates to the logic matrix whether the altitude signal frequency is above or below 115-kHz. In Modes I and III, a logic zero output is provided to the logic matrix, because the frequency is below 115-kHz and because of the test input respectively. In Mode II, a logic 1 output is provided, because the frequency is above 115-kHz.

(d) VSWR Monitor

• Late model VSWR monitor module is used only in Mode II to indicate the operational condition and loop gain of antennas and antenna cables.

• The signal used by the VSWR monitor is obtained by switching the circulators.

• The VSWR monitor checks loop gain, transmitter VSWR, and receiver VSWR every 4-seconds when in operate.

• Low loop gain or high VSWR on either transmit or receive VSWR check produces a warn output.

• The VSWR monitor provides logic zero (negative going pulse) to the logic matrix.

R • The VSWR monitor is not used in Mode I due to
R signal presence and does not operate until signal presence is lost.

• Mode III test signal provides logic zero output to the logic matrix.

• Early model VSWR monitor is used only in Mode II to indicate operational condition of antennas and antenna cables.

• The signal used by the VSWR monitor originates as a result of VSWR adjustment into the antenna cables by means of tuning stubs.

• The operation of the VSWR monitor is based on the principle that any change in operational condition of antennas or cables will result in a change in VSWR and signal level resulting from the VSWR.

• The VSWR monitor circuit can be described as a "window."If the VSWR signal level is higher or lower than a definite range of values, the VSWR

monitor will provide a warn (logic zero) output to the logic matrix.

• The VSWR monitor is not used in Mode I; because, if the return signal is satisfactory (no warn outputs from other monitors), antennas and cables must be operating satisfactorily. In Mode III, the test signal input to the VSWR monitor causes a logic zero to the logic matrix.

(e) Comparator Monitor

The comparator circuit monitors two altitude output voltages from the operational amplifiers by comparing them. If the voltages do not agree within 50-mv, a logic zero is provided to the logic matrix. In Mode III, two operational amplifiers are deliberately unbalanced to cause the comparator to provide a logic zero output.

(7) Logic Matrix

The logic matrix is the computer portion of the receiver-transmitter. It establishes the mode of operation and, by means of the monitor inputs, determines the operational condition of the Radio Altimeter System.

In Mode II, an output from the logic matrix activates the off-scale oscillator. This same output causes a gain increase in the preamp and tracking filter to make it more responsive to the low-frequency, low-level VSWR signal. This same output might exist in Mode I in the event of signal loss or equipment failure. The logic matrix also provides two reliability outputs to the Radio Altitude Indicator. The action resulting from these outputs depends on the type of indicator used.

The autopilot warn output will warn that altitude information is unreliable. It also disables the altitude trips. In Mode III, all inputs to the logic matrix are logic zero. This is done to test the logic matrix.

(8) Off-Scale Oscillator

The off-scale oscillator is activated in Mode II to provide a high-altitude signal to maintain operation (for monitoring purposes) when no ground return signal is present and to hold the Radio Altitude Indicator pointer hidden behind the mask.

(9) Unity Gain Amplifier

The unity gain amplifier is used only to provide the necessary additional power to the four low altitude trips.

(10) Altitude Trips

The altitude trips provide an open circuit above the set altitude and a closed circuit below the set altitude.

(11) Fault Indicators

The fault indicator circuits are a maintenance aid to shorten turn-around time. When a malfunction occurs in the system, a fault indicator is actuated showing the location of the trouble: RT unit, Indicator, or Antennas or Antenna cables. A time delay is built into the fault indicator circuits so a malfunction in the system must persist for approximately 5-seconds before the fault indicator involved will be actuated. Once actuated, the fault indicator must be manually reset by ground maintenance personnel. The fault indicator circuits are not monitored since they have no effect on prime functions of the system. The fault indicator circuits are disabled during self-test to prevent unwarranted actuation of the indicators.

(12) Radio Altimeter Features Unique to Serial Number 4000 and Above (Ref. Fig. 4).

(a) ±30-Volt DC Power Supply Monitor

The power supply monitor compares the +30-volt dc level to the -30-volt dc level and provides a signal to the logic. When either supply changes beyond prescribed limits, there is a warn logic zero output to the flag alarm circuit.

(b) Pulse Generator

The logic system is totally pulse operated. A pulse is applied at an approximate 140-Hz rate to each monitor. If the pulse is processed by the circuit, the monitor is operative. No pulse output indicates a fault condition. The results of these independent tests are processed to produce a single go/no-go flag warning.

The the following is true at all times: each essential function must be operating properly;

each related monitor must be capable of detecting a fault; and circuits in the logic between the essential circuits and the flag alarm output from the receiver-transmittter must be operating properly, or there will be an ouput to the flag.

(c) Flag and Pointer Drivers

The pointer is monitored and a flag warning results if the pointer is stowed off-scale and cannot come on-scale, or if the pointer is on-scale and should not be.

(d) Fail-Safe A/P Warn Supply, Fail-Safe Flag Supply

The flag supply voltage and A/P WARN voltages are generated from ac sources. When the A/P switch is in the NO-WARN state, the logic is providing assurance that the WARN state can be achieved when required.

(e) Self-Test

The self-test circuits provide a convenient means of verifying system accuracy, pointer and flag mechanism operation. The flag alarm output is switched to the WARN state to verify mechanical operation of the flag.

Self-test is not used to determine the operational condition of the monitors. The pulses continuously applied to all monitors verify the monitor is capable of detecting a failure. In this manner, the ability to monitor is given the same significance as the ability to determine and supply accurate information.

3. 860F-4 Receiver-Transmitter (RT)

A. Description

(1) Transmitter and Chassis Circuits

(a) Chassis A1

Chassis A1 contains three interconnect boards, rear connector, a front panel TEST connector, and an R/T UNIT TEST/STATUS switch/lamp combination. Electrical connections are made using a ribbon-type cable between interconnect board A1A3 secured to the chassis, and interconnect board

A1A1 secured to the swingout panel by A1A2 which is secured to the rear connector.

(b) Modulator A2

Modulator A2 contains a 100-Hz, triangle-wave generator, IF amplifier section, mutual interference detector, and two calibration signal amplifiers. The 100-Hz generator used to modulate the transmitter consists of a programmable binary counter, a digital-to-analog converter, and a linearizer. The IF amplifier section consists of a preamplifier, a tracking filter, limiter, time domain noise filter, and a signal presence detector. The mutual interference detector, used to detect when another altimeter is approaching modulation phase alignment, consists of a 500-kHz bandpass filter and a threat comparator.

(c) Receiver/Transmitter A3

Receiver/transmitter A3 consists of three subassemblies: receiver A3A1, transmitter A3A2, and calibration monitor A3A3. Receiver A3A1 compares the transmitter frequency with the frequency of the delayed ground-reflected signal, and produces the difference frequency that is proportional to the altitude. Receiver A3A1 consists of a preselector filter, two pin diode switches, a calibration mixer, a double balanced receiver mixer, five directional couplers, and an acoustic delay line.

R Transmitter A3A2, which is modulated by a 100-Hz
R triangle wave, produces an FMCW output centered at 4300 MHz. It consists of a two-stage oscillator-amplifier with bias amplifiers and is mounted on a laminated microstrip.

Calibration monitor A3A3 consists of a calibration mixer, second acoustic delay line, and associated directional couplers, and is used as reference for the monitor channel.

(d) Altitude Processor A4

Altitude processor A4 computes aircraft altitude from the beat frequency received from the receiver. A microprocessor performs altitude processing, producing both analog and digital outputs of altitude. Altitude processor A4 consists of a central processing unit (CPU),

programmable read only memory (PROM), random access memory (RAM), clock generator and bus control circuit, input/output (I/O) interface adapters, input converter, and both digital and analog output converters.

(e) Monitor A5

Monitor A5 consists of a power supply monitor, an altitude monitor comparator, an instrument flag oscillator and driver, and an autopilot flag oscillator and driver. These circuits hold the indicator flags out of view as long as a fault does not occur in the power supply or in the altitude computation.

(f) Monitor Processor A6

Monitor processor A6 is basically the same as altitude processor A4. It has a microprocessor that also computes altitude; however, it does not produce analog and digital altitude outputs. Instead, the microprocessor compares its computational results with results from altitude processor A4 and provides appropriate validity signals to monitor A5.

(g) Power Supply A7

Power supply A7, located inside the chassis, operates on single-phase, 115-V, 400-Hz power. The power supply contains rectifiers and regulators producing +30-, +25-, +12-, +5-, -5-, -12-, -19.2-, -30-, -32-, and -42-V dc power. The power supply also produces 26-V ac, 400-Hz power for external use.

(h) Altitude Trips A8

Altitude trips A8 contains six adjustable trip circuits. Each circuit will energize a relay whenever the altitude decreases to or below the adjusted decision height.

(i) General

The unit supplies two dc output voltages representing true altitude of the aircraft above the terrain. Each of these outputs is capable of driving a maximum of five 10,000-ohm loads; no dummy load resistor strapping is required. In addition, six altitude trips are provided. These

can be used to activate external flight control, flight director systems, altitude warning or indicating devices. The trips provide a closed circuit when the aircraft is below the set point of the individual trip, and an open circuit above.

All electrical connections are made through the rear connector. The front panel connector is used for flight-line testing of the Radio Altimeter System using the 980N-1 Altimeter Test Set or equivalent. The front panel connector has limited use in bench troubleshooting and testing. During operation initiated self-test the altitude indicator displays 30-feet and the flag drops into view.

B. Operation

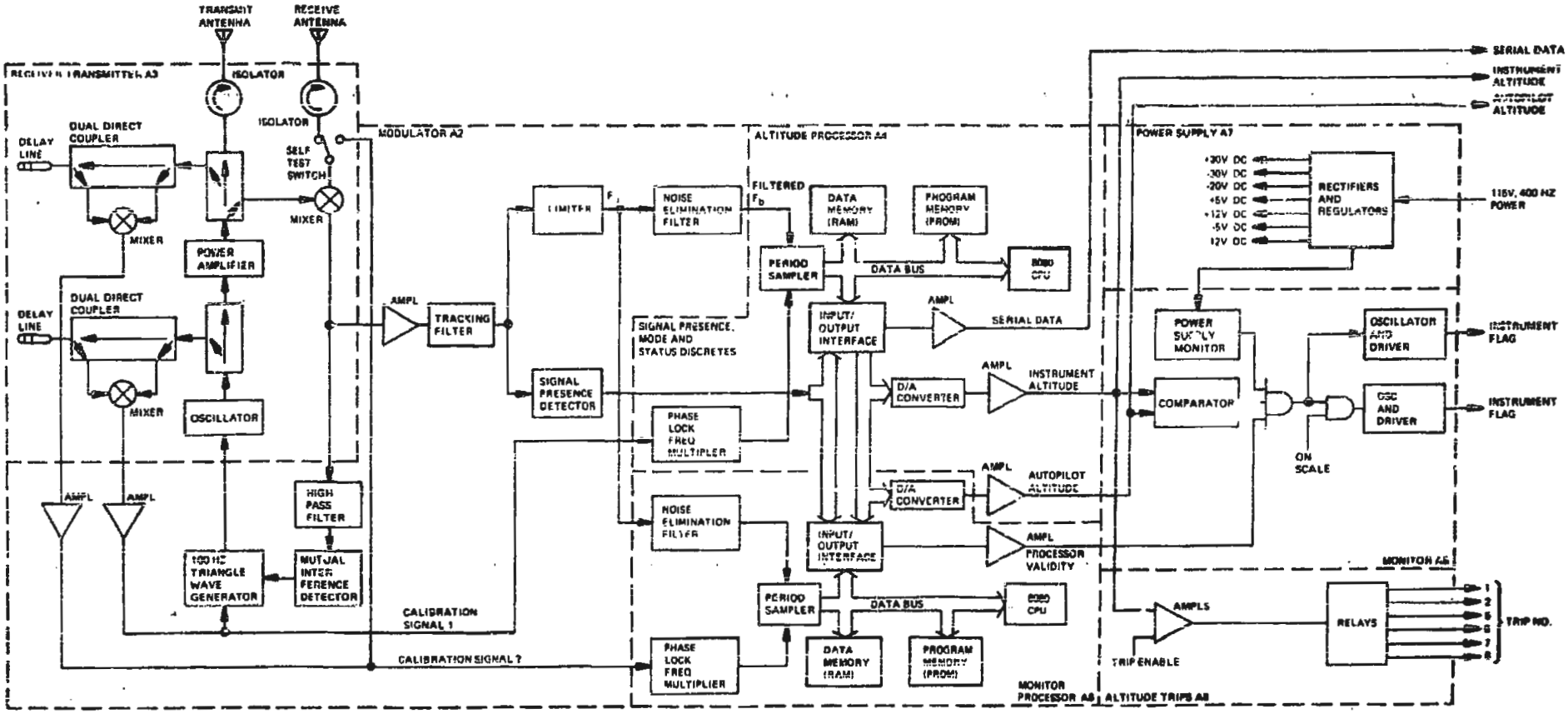
(1) General

The RT has three modes of operation. Mode I occurs under normal operating conditions at altitudes below 2500-feet. Mode II occurs at altitudes above 2500-feet. Two internally generated signals maintain the operational condition to permit monitoring. Mode III is a system self-test. Mode I and Mode II are automatic functions dependent upon altitude and related variable parameters which include operational condition, terrain reflection characteristics, and atmospheric conditions. Because of these parameters, the transition from Mode I to Mode II may extend through an altitude variation as great as 1000-feet.

(2) Modulator and Transmitter

The modulator is a 100-Hz triangle-wave generator consisting of an 8-bit binary up/down counter and digital-to-anlog (d/a) converter. The count continually cycles from zeros to ones and back, with 256-counts making a half cycle. The eight bits are summed in the d/a converter to make a staircase waveform, which is filtered to make a smooth waveform. This waveform, which is the complement of the capacitance voltage curve of the transmitter tuning varactor, allows the frequency modulation to be linear.

The transmitter consists of an oscillator and power amplifier, both using 1-watt 4-GHz transistors. Frequency modulation is achieved by applying the triangular voltage waveform to the varactor in the oscillator circuit. The mean voltage of this waveform, adjusted by a control on the modulator, determines the



R
R 860F-4 Receiver-Transmitter Block Diagram
Figure 5

R EFFECTIVITY: ALL
R
001B

center frequency of the oscillator. The 4300-MHz FMCW oscillator output passes through a directional coupler and amplified by the power amplifier. The amplifier output is routed through a second directional coupler and an isolator, or terminated 3-port circulator, to the transmit antenna.

Each directional coupler is connected to a quartz bulk acoustic delay line that is the equivalent of 300-feet of altitude. The delayed signal is heterodyned in a mixer with the non-delayed signal applied from the transmitter. The mixer output is the difference frequency of approximately 12-kHz, which is amplified and limited into a square wave. One delay line circuit produces the CALIBRATION SIGNAL 1, which is used for comparison purposes in the altitude processor. The other delay circuit produces the CALIBRATION SIGNAL 2, which is used in the monitor processor.

(2) Receiver

The delayed reflected signal picked up by the receive antenna is routed through an isolator to a mixer. The other input to the mixer is a sampling of the transmitter signal from a 25-dB directional coupler. The mixer heterodynes the two signals to produce a difference or beat frequency. Because of the modulation, this frequency is proportional to the time required for the round trip to the terrain by the transmitted signal. The difference or altitude signal frequency changes at the rate of approximately 40-Hz per foot of altitude.

The mixer output is applied to a preamplifier on the modulator whose output is routed through a tracking filter to a limiter. The tracking filter and associated amplifiers are controlled by the altitude processor which selects the correct receiver passband shape for the altitude being tracked. The shaped amplification increases the gain with increasing altitude. That is, the high-frequency response is increased to make the amplifiers more responsive to high altitude frequencies, and the low-frequency response is reduced to improve the high-frequency tracking capabilites. The output of the limiter is a relatively constant amplitude altitude beat frequency.

(3) Altitude Processing

Altitude processing is accomplished by a general purpose microcomputer. The microcomputer consists of an 8080 central processing unit (CPU), a programmable

read-only-memory (PROM) for program memory, a random-access-memory for data memory, and input/output (I/O) interface circuits.

The processed receive signal or filtered beat frequency signal, along with the 12-kHz CALIBRATION SIGNAL 1, are applied to the altitude processor. As previously mentioned, the processed receive signal is proportional to the altitude, and the calibration signal is proportional to the reference delay line. These two signals are applied to a ratio circuit or period sampler whose output is in the form of parallel digital words.

The digital data words are continuously loaded into the working memory of the microcomputer. The microcomputer operates on the data to derive a running average, applies correction factors for aircraft installation delay (AID), controls bandwidth of the receiver, computes the logarithm of altitude (if required), and couples the final altitude answer to the digital-to-analog (d/a) converters. The d/a converters and associated amplifiers convert the digital answer to the dc altitude analog signals required for compatibility with the instrument and aircraft autopilot.

(4) Monitor Processing

The unit has two reference delay lines producing independent calibration frequencies, CALIBRATION SIGNALS 1 and 2. CALIBRATION SIGNAL 2, from the cabibration monitor, is applied to the monitor processor, which is essentially identical to the altitude processor, except for the stored program used. The monitor processor computes altitude in the same way as the altitude processor and compares the two computed altitude answers. If the two answers are within a predetermined comparison threshold, the PROCESSOR VALIDITY signal is sent to the monitor. The comparison threshold is 3-feet or 3-percent of the indicated altitude, whichever is greater. If the two answers are outside the threshold, the PROCESSOR VALIDITY signal is interrupted, this causes a warning to be given to the radio altimeter indicator and to the autopilot.

The monitor processor also initiates periodic test routines to ensure that the rf, if, and signal presence functions are operating properly. Failure of the test cycles will result in a warning being produced.

(5) Monitor

The monitor accepts the PROCESSOR VALIDITY signal from the monitor processor and combines the information of several other monitors to determine the integrity of the unit. The other circuits monitored are dc power supplies, altitude analog drivers in the altitude processor, and pin diode switches in the receiver. Fail-safe logic is used to the maximum possible extent. A valid output requires continual switching of the monitor outputs. Therefore, part failures causing the logic to get stuck at one or at zero will result in a loss of validity. The final validity signal is applied to an oscillator and driver circuit that producing a high level INSTRUMENT FLAG signal.

An optional second flag driver operates from the same information as the radio altitude indicator flag, and produces the AUTOPILOT FLAG signal. In addition, this signal reverts to the invalid state when the altitude is above the range of the altimeter (2500-feet) as indicated by the ON SCALE signal.

(6) Power Supply

The power supply operates on 115-V, 400-Hz, single-phase power from the aircraft system. Rectifiers and regulators in the power supply produce +30-, -30-, +12-, +5-, -5-, and -20-V dc outputs. A 26-V, 400-Hz output is also produced to power the radio altitude indicator.

(7) Altitude Trips

The instrument altitude signal from the alitude processor is applied to differential amplifiers in the altitude trips. The other inputs to the amplifiers are the preset trim signals. The output of the amplifiers are used to energize trip relays. The relay contacts close at preset altitudes on aircraft descent. The trip points are shop adjustable and are capable of modification by programming resistors in the aircraft. The trips are disabled when the monitor detects a malfunction.

4. Antenna

Two antennas are used with each of the two radio altimeter systems (Ref. Fig. 1). One antenna is used to transmit, the other is used to receive RF energy. The antennas are identical and are housed in a metal case. The antennas are flush-mounted to the bottom of the aircraft fuselage, zone 142. A single mating connector provides system interface.

5. Radio Altitude Indicator

A. Description

The radio altitude indicator is contained in a metal housing. Two identical indicators are installed on the aircraft; one is located on the Captains instrument panel, zone 211; and one is located on the First Officers instrument panel, zone 212. A single 32-pin electrical connector provides system interface.

The altitude indicator consists of an electronic assembly and a mechanical assembly..

(1) The mechanical assembly consists of the DH and altitude tapes, the servo mechanism to drive the tapes, and the DH counter. Electrical components mounted on the assembly include the DH lamps, the DH and feedback potentiometers, the flag and solenoid, and terminal board TB3.

(2) The electronic assembly consists of two terminal boards and chassis-mounted components. The DH light relay, off-scale sensor, pulse generator, and power supply are mounted on TB1. Six modules, A1 through A6, and associated components are mounted on terminal board TB2. Transformer T3 and relay K1 are mounted on the chassis.

The radio altitude indicator (Ref. Fig. 6) performs the following functions:

(1) Converts altitude analog voltage to an accurate visual indication of aircraft altitude

(2) Provides a means of warning the flight crew when a malfunction occurs in any part of the radio altimeter system, except X-CONN monitoring.

(3) Provides a means to alert the flight crew when the aircraft has descended to a predetermined decision height (DH) altitude.

(4) The radio altitude indicator contains the following operating controls and indicators:

R (a) Aircraft Reference Symbol and Altitude Display Tape

Aircraft altitude (in feet) is displayed by a servo-driven tape containing a calibrated scale

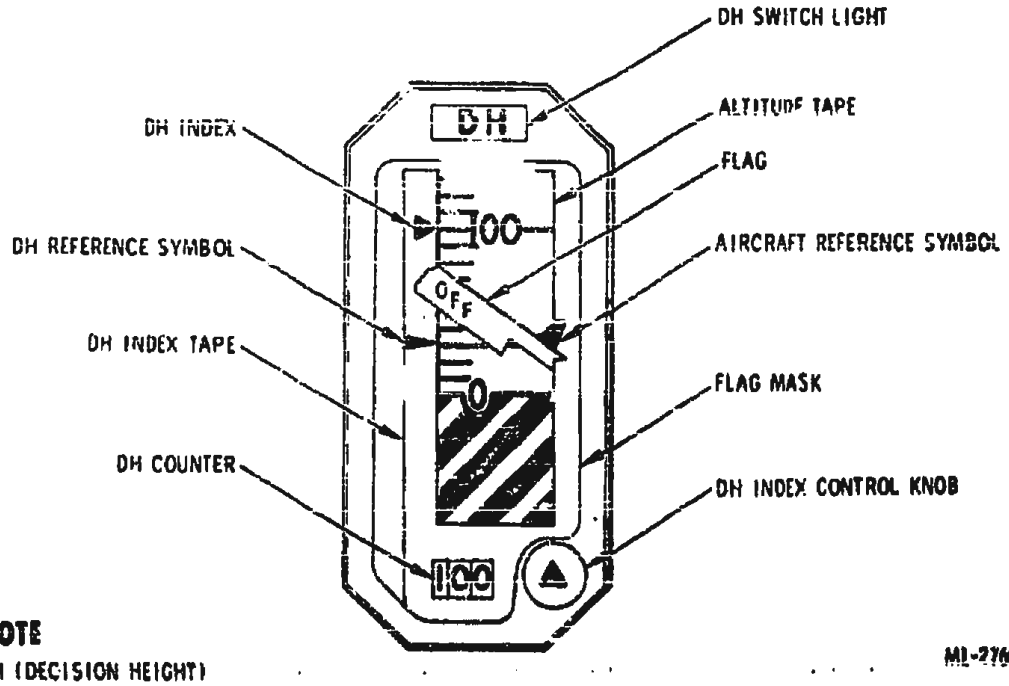
that is read against a stationary aircraft reference symbol.

R (b) DH Index

The DH index is manually positioned when the SET knob on the radio altitude indicator is adjusted to the desired altitude as displayed by the digital counter. The index is a triangle or black tape that moves with the altitude display tape. The index is always at a position coincident with the scale mark on the display tape corresponding to the adjusted DH altitude.

R (c) SET Knob and DH Counter

The SET knob adjusts the digit counter and DH index to the desired DH altitude. The DH counter provides a 3-digit indication of the adjusted DH from 0- to 499 feet. A mechanical stop permits adjustment from -20 to approximately 550-feet. When the knob is adjusted to a DH below 0-feet, the counter is hidden by a black and white striped mask. When the knob is adjusted to a DH above 499-feet, the counter is hidden by a black mask.



NOTE

DH (DECISION HEIGHT)

Radio Altitude Indicator
Figure 6

R (d) DH Lamp

The DH lamp is amber with black lettering. The lamp can be turned on by the internal DH trip circuit and by three of the six altitude trip outputs. The DH light can be turned off by the flight crew after it has turned on by a push-off switch that is an integral part of the DH lamp assembly.

R NOTE: The DH light on the ADI (Ref. 34-21-00) operates in parallel with the radio altitude indicator DH light.

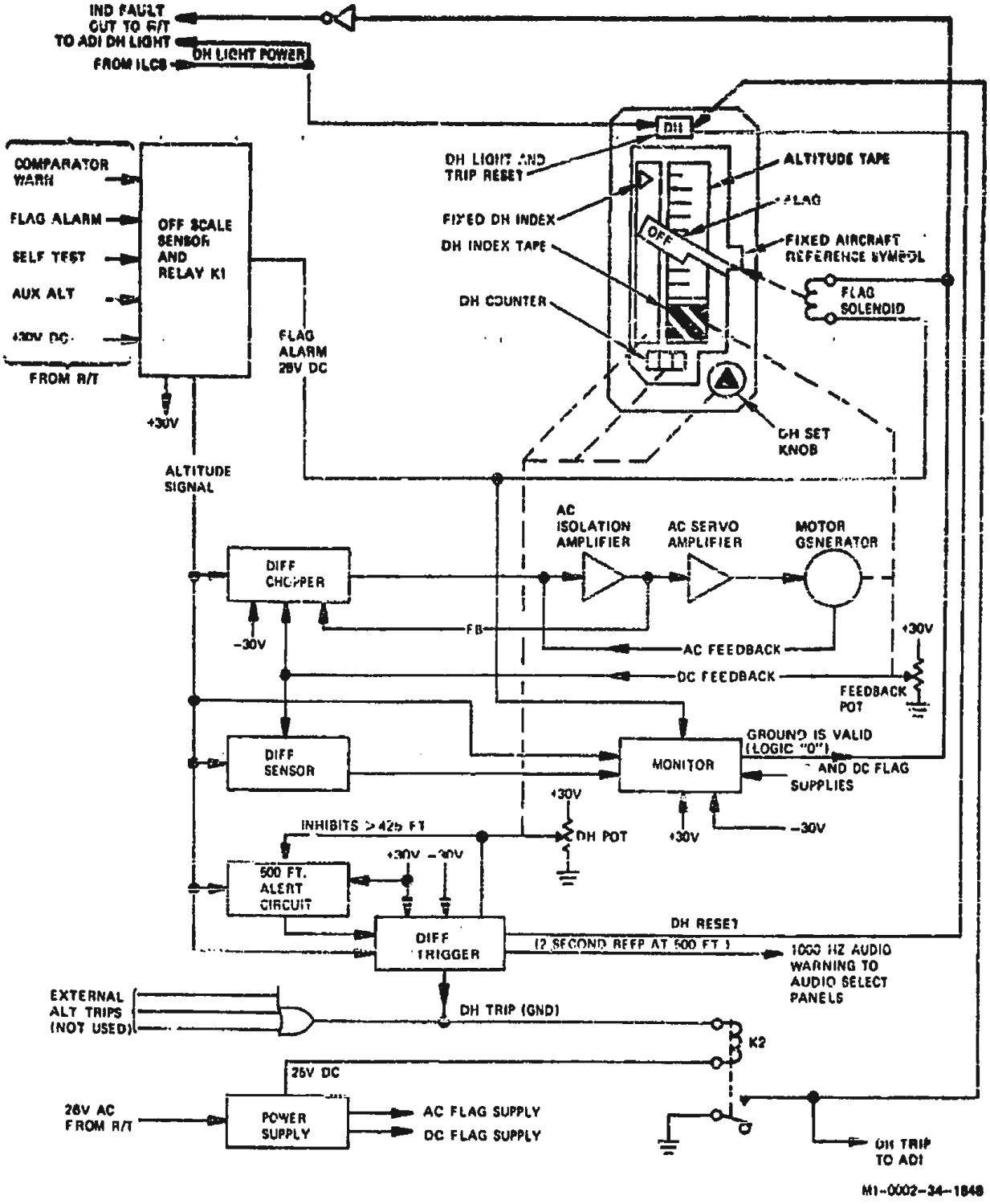
R (e) Flag

The flag is attached to a normally energized solenoid that holds the flag out of view behind the flag mask during normal system operation. The flag comes into view when a failure occurs in the system or during self test. The flag will not come into view with an X-CONN problem on 860F-1 RT units.

The radio altitude indicator(Ref. Fig. 7)receives an altitude signal from the RT. The positive dc altitude voltage is applied through a relay to a differential chopper, a differential sensor, and differential trigger module. A positive dc feedback voltage from the wiper of the feedback potentiometer is also applied to the differential chopper. The dc feedback voltage represents the position of the altitude display tape, and dc altitude voltage represents aircraft altitude. When the two signals applied to the chopper are not equal in value, an ac difference output voltage is produced. The chopper output is amplified and applied to an ac servo amplifier. The ac servo amplifier drives the motor-generator, driving the altitude display tape to the correct altitude. An ac feedback signal from the motor-generator stabilizes the servo loop.

The dc feedback voltage is also applied to the differential sensor. When the difference between the altitude voltage and the feedback voltage is greater than a predetermined level, there is an output from the differential sensor. This output is applied to the monitor causing the flag to appear. The flag also appears as a result of loss of flag voltage, loss of ±30-V reference voltage, loss of 26-V ac power, monitor output circuit failure, and during self-test.

The DH (decision height) is set by rotating the SET knob until the desired DH is indicated on the DH counter. The



R Radio Altitude Indicator Functional Block Diagram
R Figure 7

wiper of the DH potentiometer is also adjusted by the SET knob. When the altitude signal and the voltage from the DH potentiometer are equal, a ground from the differential trigger module energizes DH relay (K2) causing the DH light on both the radio altitude indicator and ADI to come on. The DH light can be turned off by pushing the DH light lens.

At 50-feet above DH setting, a 1000-Hz audio warn output is produced which has a duty cycle of 50 milliseconds on, 500 milliseconds off. The off period of the duty cycle decreases in time proportionately to altitude signal decrease. At DH, the duty cycle is 50 milliseconds on, 50 milliseconds off. This signal is applied to the audio selector panels. When DH is reached, the audio signal is turned off and the DH lights on both indicators are turned on.

A two (2)-second, 1000-Hz, audio warning is also heard as the aircraft descends through 500-feet.

Loss of flag alarm voltage, comparator warning signal, or self-test input causes the indicator altitude tape to go off scale and the flag to come into view.

As a result of system self-monitoring, proper operation of all system components is ensured. The monitoring not only ensures accurate altitude information within the normal operating range of the altimeter, but also monitors the system to assure proper operation while the aircraft is at cruise altitudes. The altitude trip outputs are not monitored.

R 6. ADI Radio Altitude Indicator

R A. Description

R The ADI (Ref. 34-25-00) radio altitude indicator is located
R at the lower right of the indicator. It is uncovered if the
R flag alarm is valid and altitude is below 200 feet. The
R indicator is a meter movement and comes into view at 200
R feet, rising to touchdown.

RADIO ALTIMETER SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code, the code number can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

NOTE: The Collins 860F-1 analog altimeter is no longer being manufactured. The replacement for this is the 860F-4 digital altimeter which is directly interchangeable. Consequently, schematics are included to cover the possibility of these units appearing in your fleet.

2. Equipment and Materials

Altimeter Test Set, P/N 137-34-329 (Collins 980N-1), or equivalent

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide component locations for Radio Altimeter System and associated components.

Fault Isolation Diagrams and Schematics List
Table 101

	FIG. NO.	TITLE
	101	Component Location Index
	102	Component Locator Diagram
R	103	Radio Altimeter System Faults
	SCHEM1 (Sheet 1)	Radio Altimeter System Schematic (No. 1 & No. 2 R/T)
	SCHEM 1 (Sheet 2)	Radio Altimeter System Schematic (Interface)
	SCHEM 1 (Sheet 3)	Radio Altimeter System Schematic (Indicators)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA – TRANSMIT	2	FUS BOTTOM, L AND R FWD	34-32-02
ANTENNA – RECEIVE	2	FUS BOTTOM, L AND R AFT	34-32-02
INDICATOR – ATTITUDE DIRECTOR	2	FLT STA, CAPT AND F/O INSTR PNL	34-21-67
INDICATOR – RADIO ALTITUDE	2	FLT STA, CAPT AND F/O INSTR PNL	34-32-04
TRANS/REC – RADIO ALTIMETER	2	MESC, L AND R RACK/131AR	34-32-01

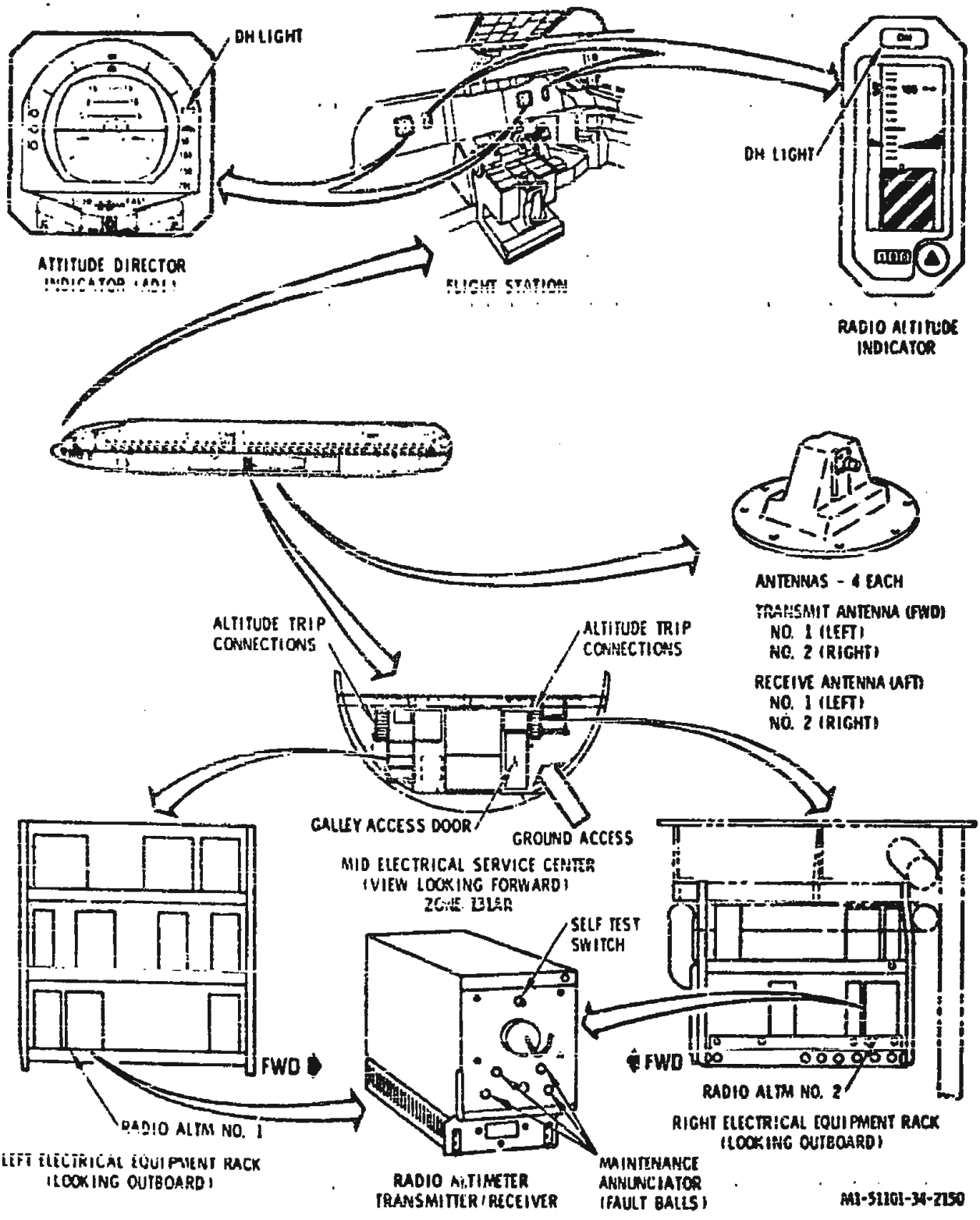
M1-0000-34-3334

R
R

Component Location Index
Figure 101

EFFECTIVITY: ALL

0018



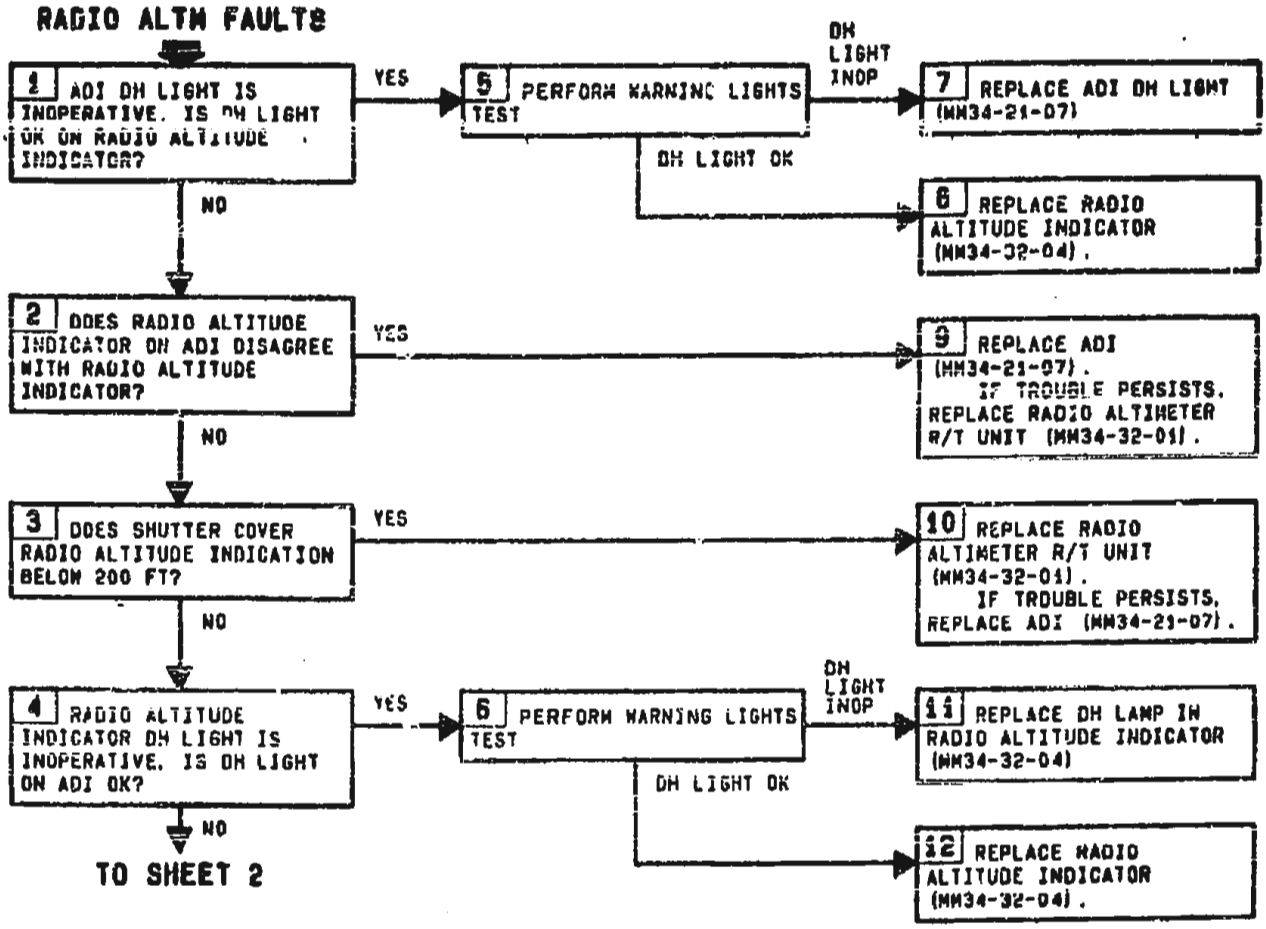
R
R

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

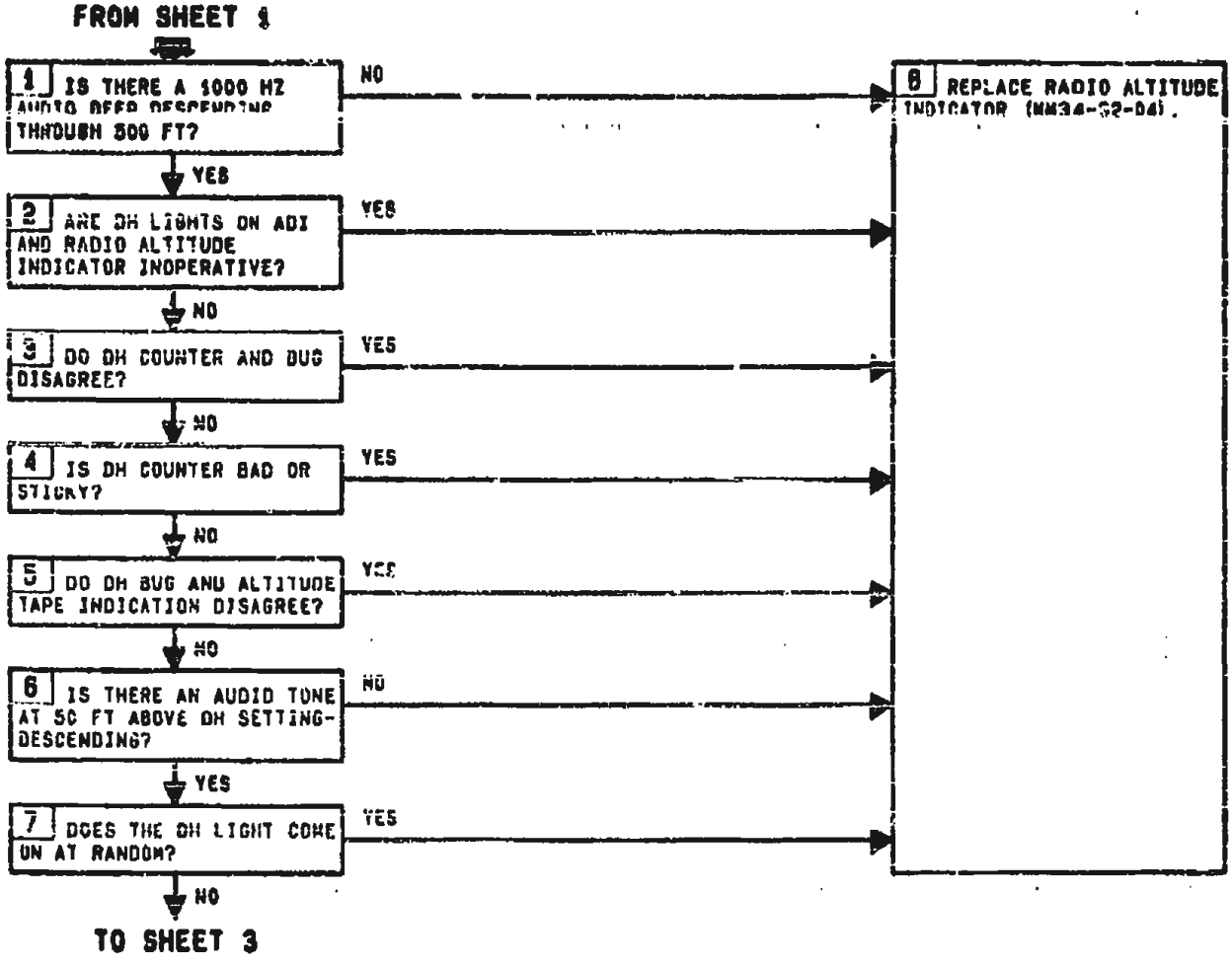
001B

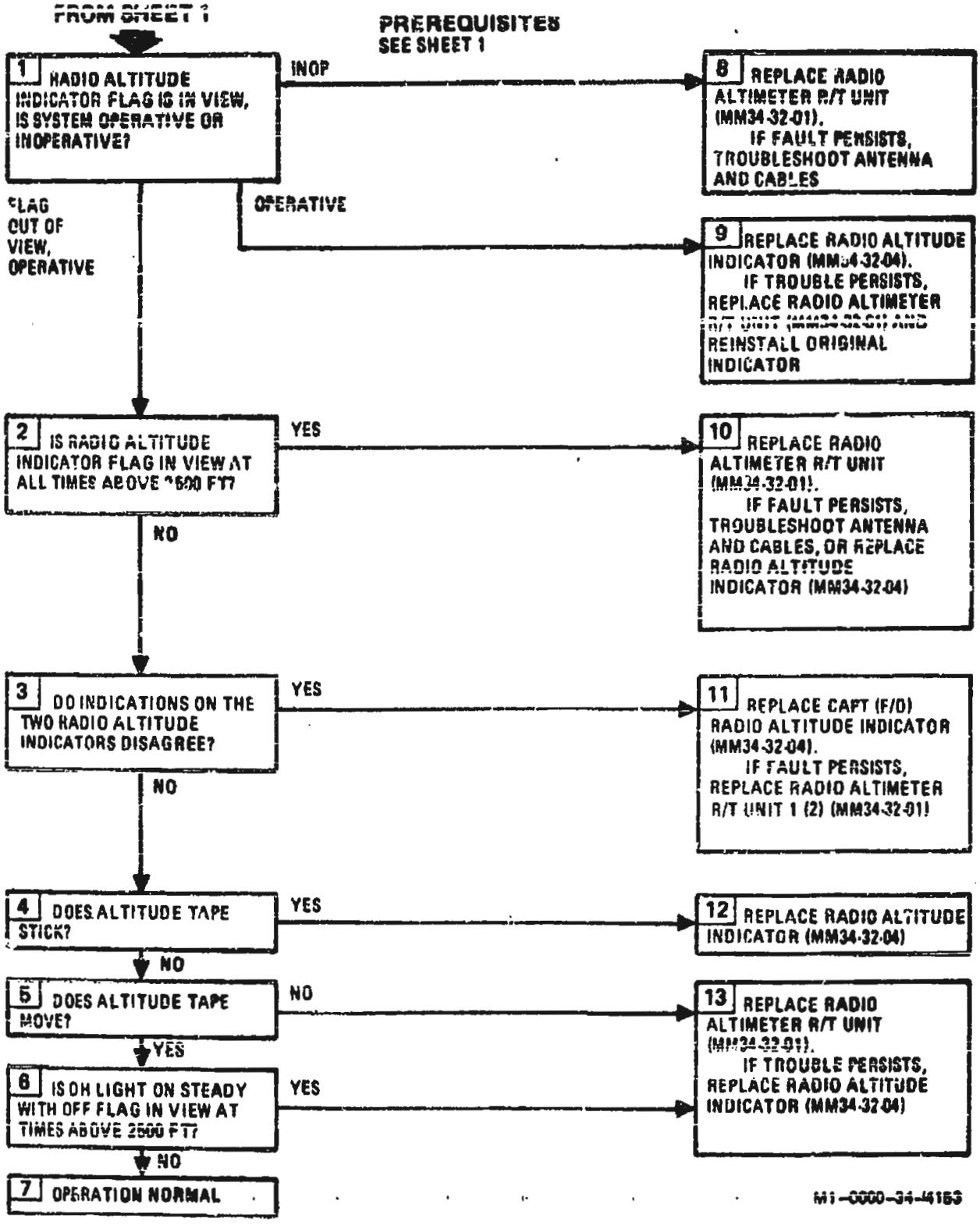
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D4, 1D22, 1F2, 1F20, 2L1
TWO MEN; ONE IN MESC AND ONE IN FLIGHT STATION. ACTIVATE SERVICE INTERPHONE (DEPRESS SERVICE INTERPHONE-ON SWITCH UNDER FE/SO TABLE) CONNECT HANDSET TO FLIGHT STATION AND MESC SERVICE INTERPHONE JACKS


RADIO ALTM FAULTS
1 ADI DH LIGHT IS INOPERATIVE. IS DH LIGHT OK ON RADIO ALTITUDE INDICATOR?
YES
5 PERFORM WARNING LIGHTS TEST
DH LIGHT INOP
7 REPLACE ADI DH LIGHT (MM34-21-07)
DH LIGHT OK
6 REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04).
NO
2 DOES RADIO ALTITUDE INDICATOR ON ADI DISAGREE WITH RADIO ALTITUDE INDICATOR?
YES
9 REPLACE ADI (MM34-21-07). IF TROUBLE PERSISTS, REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01).
NO
3 DOES SHUTTER COVER RADIO ALTITUDE INDICATION BELOW 200 FT?
YES
10 REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01). IF TROUBLE PERSISTS, REPLACE ADI (MM34-21-07).
NO
4 RADIO ALTITUDE INDICATOR DH LIGHT IS INOPERATIVE. IS DH LIGHT ON ADI OK?
YES
6 PERFORM WARNING LIGHTS TEST
DH LIGHT INOP
11 REPLACE DH LAMP IN RADIO ALTITUDE INDICATOR (MM34-32-04)
DH LIGHT OK
12 REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04).
NO
TO SHEET 2

Radio Altimeter System Faults
Figure 103 (Sheet 1)

PREREQUISITES
SEE SHEET 1

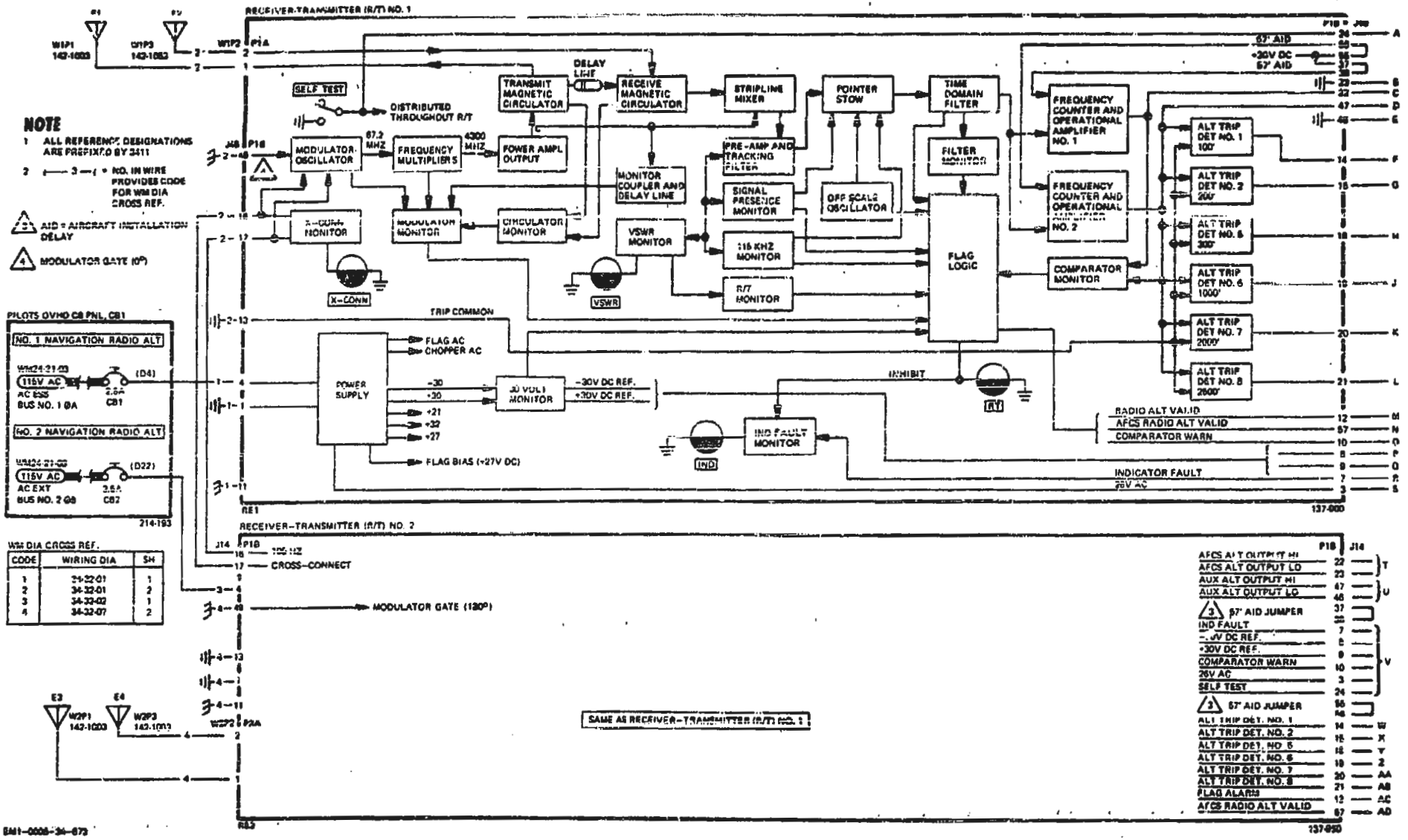



FROM SHEET 1
PREREQUISITES
SEE SHEET 1
1 RADIO ALTITUDE INDICATOR FLAG IS IN VIEW, IS SYSTEM OPERATIVE OR INOPERATIVE?
INOP
8 REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01).
IF FAULT PERSISTS, TROUBLESHOOT ANTENNA AND CABLES
FLAG OUT OF VIEW, OPERATIVE
OPERATIVE
9 REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04).
IF TROUBLE PERSISTS, REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01) AND REINSTALL ORIGINAL INDICATOR
2 IS RADIO ALTITUDE INDICATOR FLAG IN VIEW AT ALL TIMES ABOVE 1500 FT?
YES
10 REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01).
IF FAULT PERSISTS, TROUBLESHOOT ANTENNA AND CABLES, OR REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04)
NO
3 DO INDICATIONS ON THE TWO RADIO ALTITUDE INDICATORS DISAGREE?
YES
11 REPLACE CAPT (F/O) RADIO ALTITUDE INDICATOR (MM34-32-04).
IF FAULT PERSISTS, REPLACE RADIO ALTIMETER R/T UNIT 1 (2) (MM34-32-01)
NO
4 DOES ALTITUDE TAPE STICK?
YES
12 REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04)
NO
5 DOES ALTITUDE TAPE MOVE?
NO
13 REPLACE RADIO ALTIMETER R/T UNIT (MM34-32-01).
IF TROUBLE PERSISTS, REPLACE RADIO ALTITUDE INDICATOR (MM34-32-04)
YES
6 IS OH LIGHT ON STEADY WITH OFF FLAG IN VIEW AT TIMES ABOVE 2500 FT?
YES
NO
7 OPERATION NORMAL
M1-0000-34-4163

R Radio Altimeter System Faults
R Figure 103 (Sheet 3)

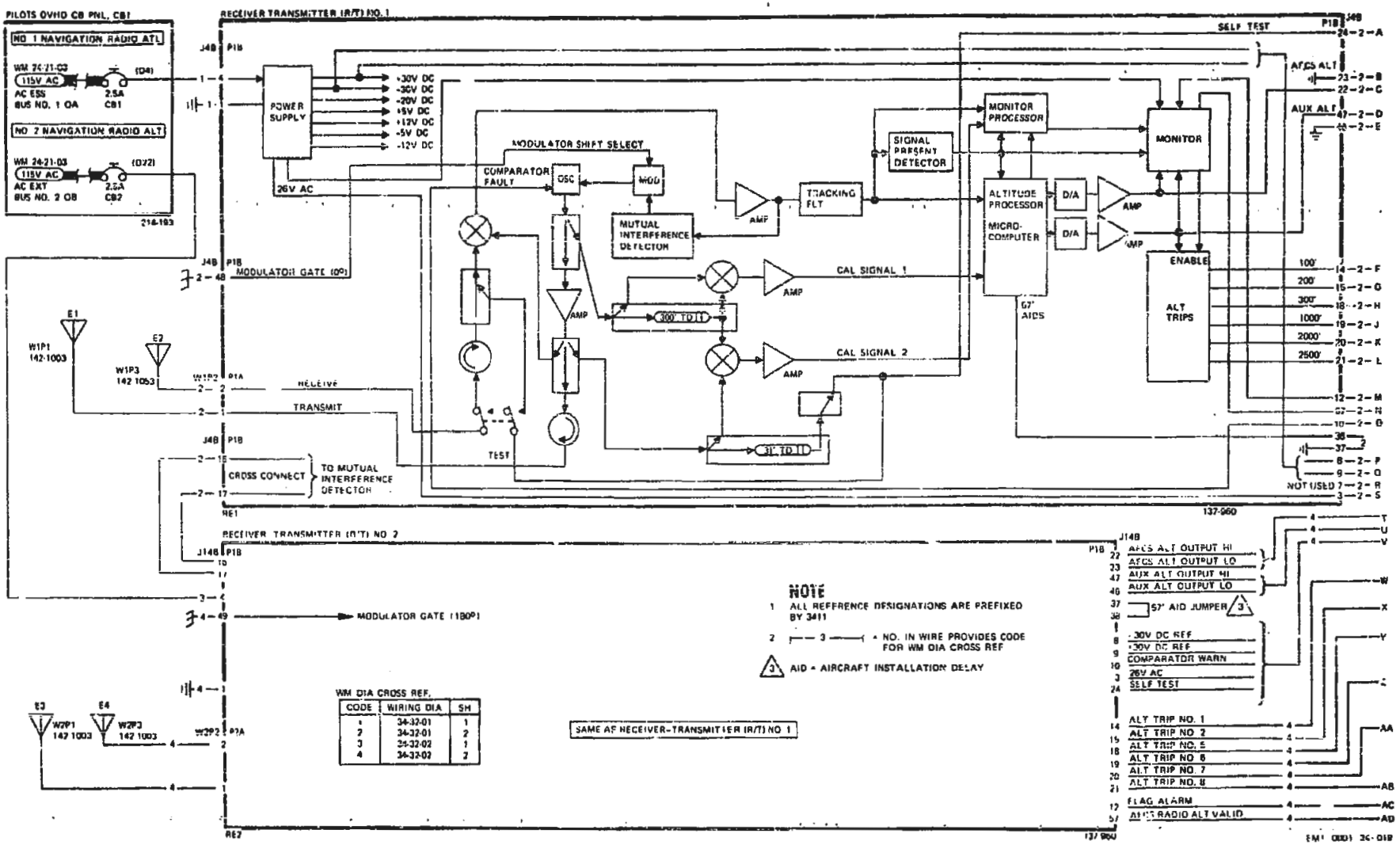
EFFECTIVITY: ALL

0018



Radio Altimeter System Schematic
SCHEM 1 (Sheet 1)

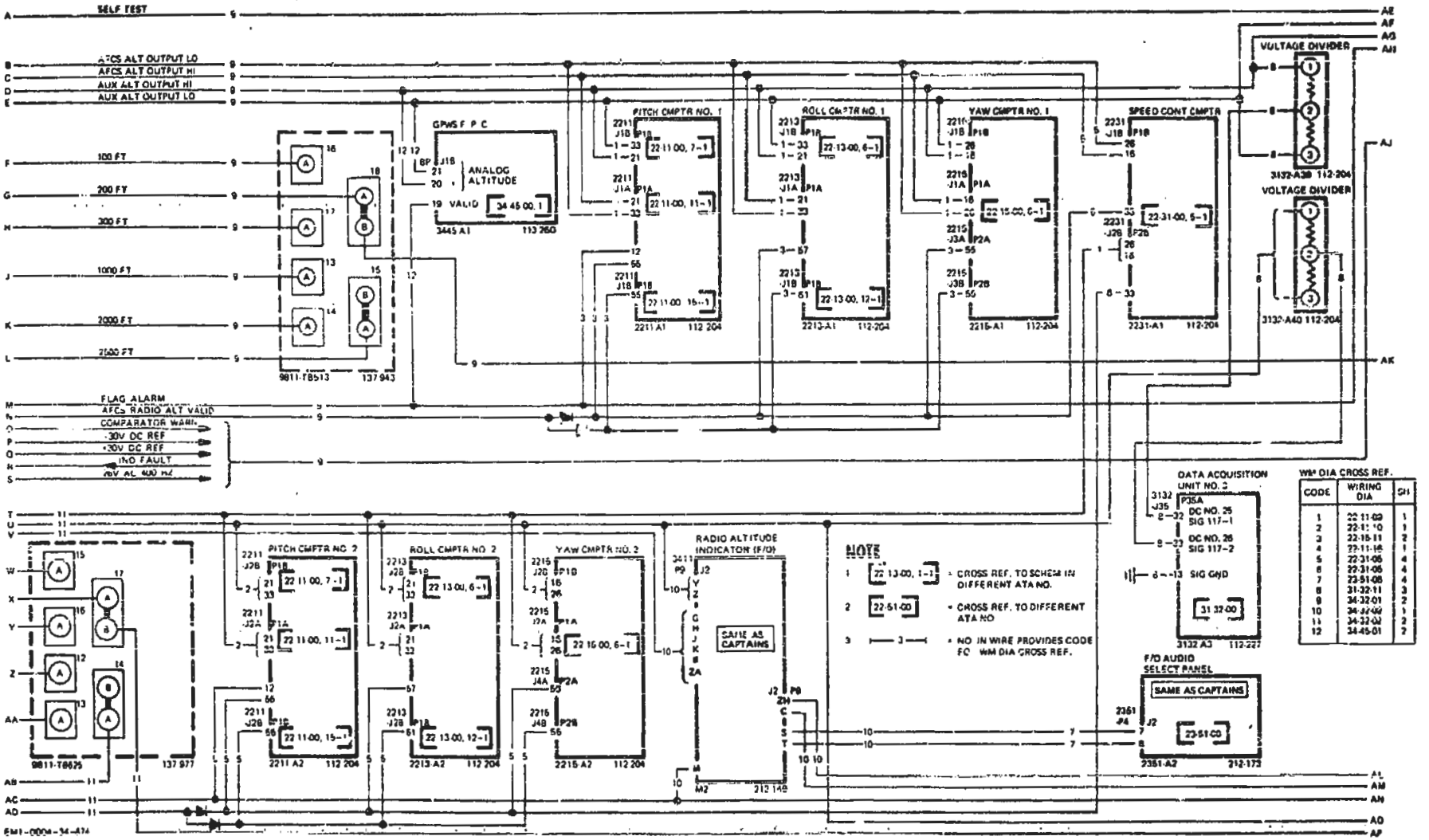
R EFFECTIVITY: A/C WITH 860F-1 ANALOG ALTIMETER
R
0019



R Radio Altimeter System Schematic
R SCHEM 1 (Sheet 1)

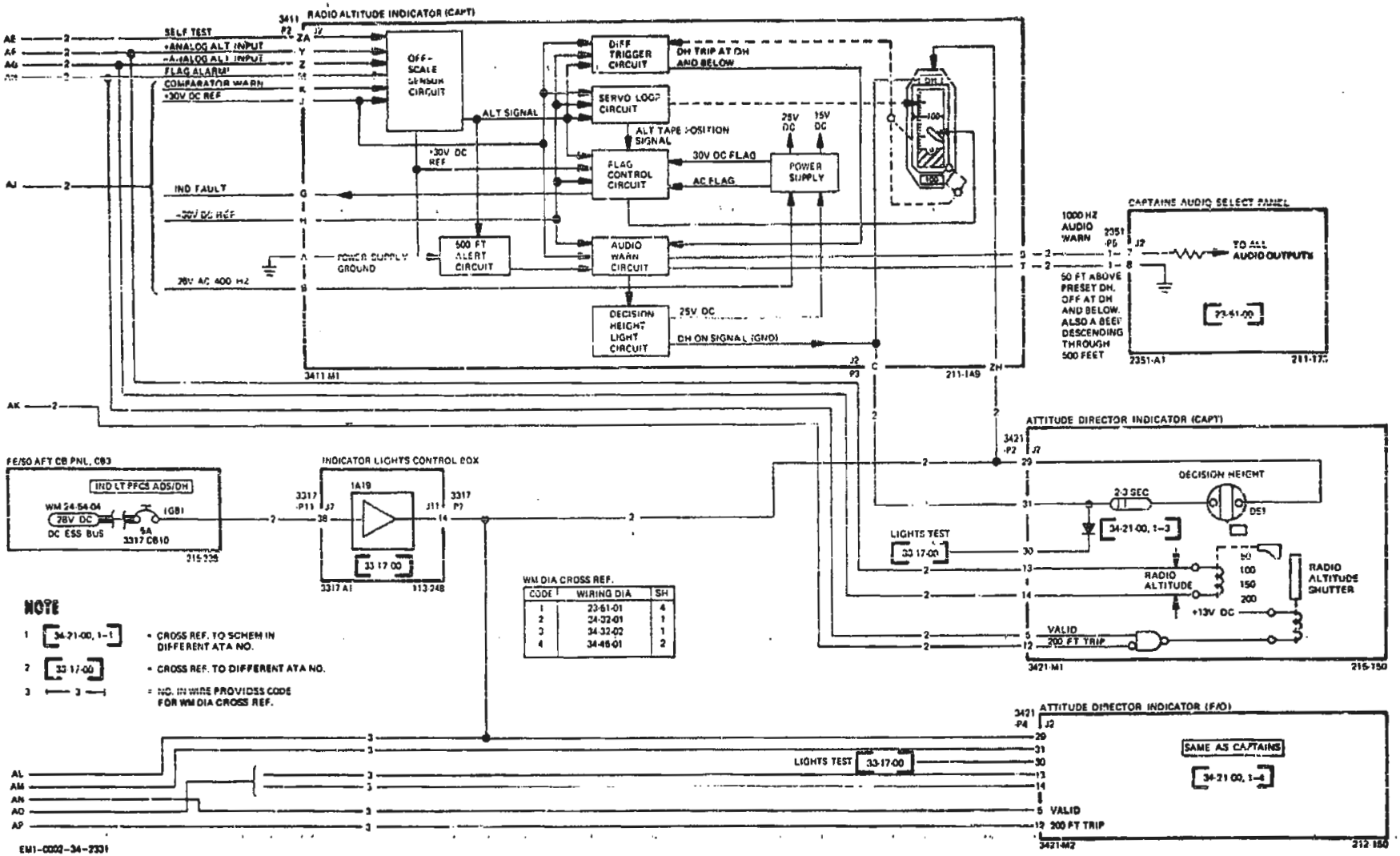
EFFECTIVITY: A/C WITH 860F-4 DIGITAL ALTIMETER

0018



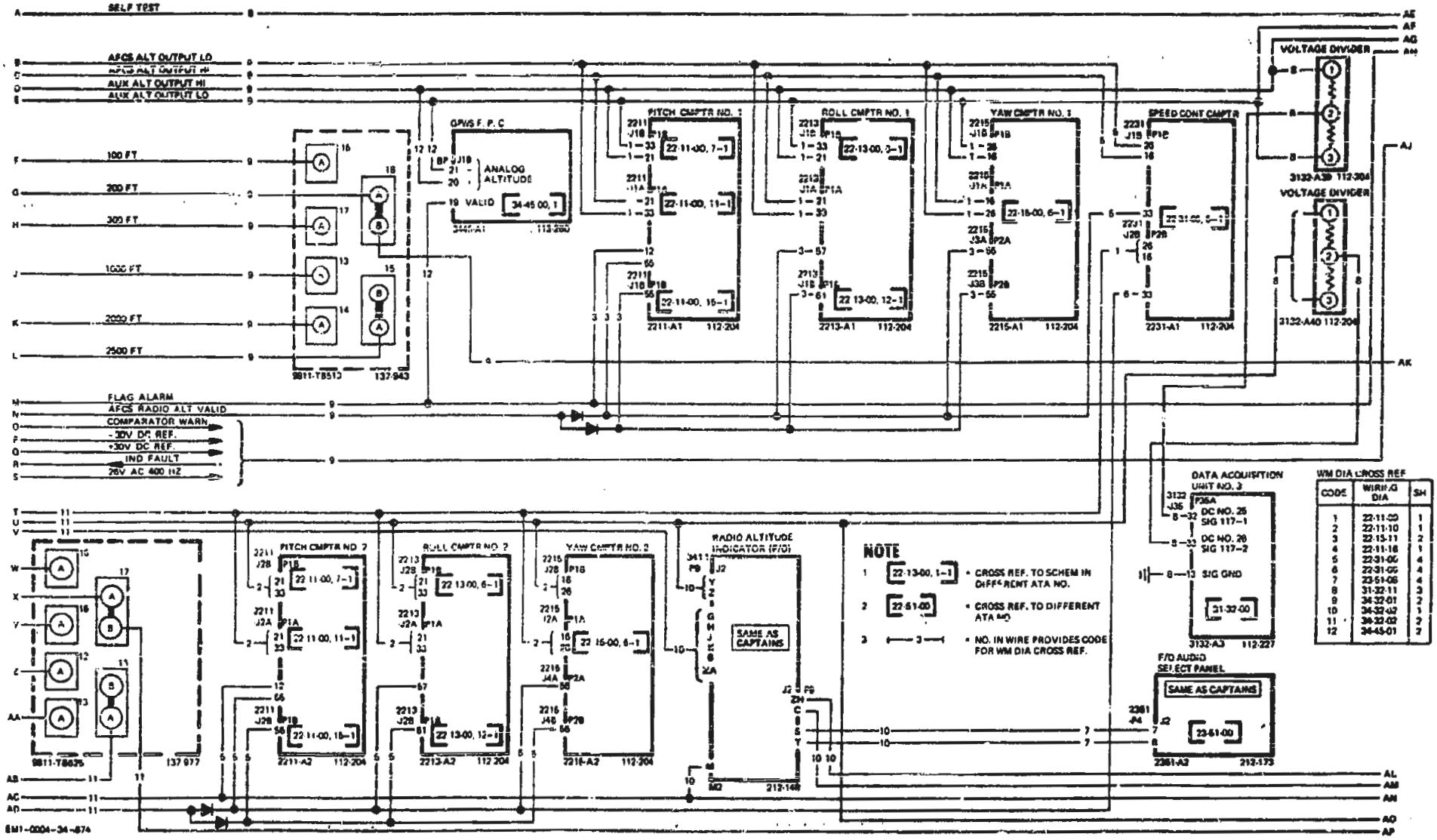
Radio Altimeter System Schematic
SCHEM 1 (Sheet 2)

R
R
001B EFFECTIVITY: ALL



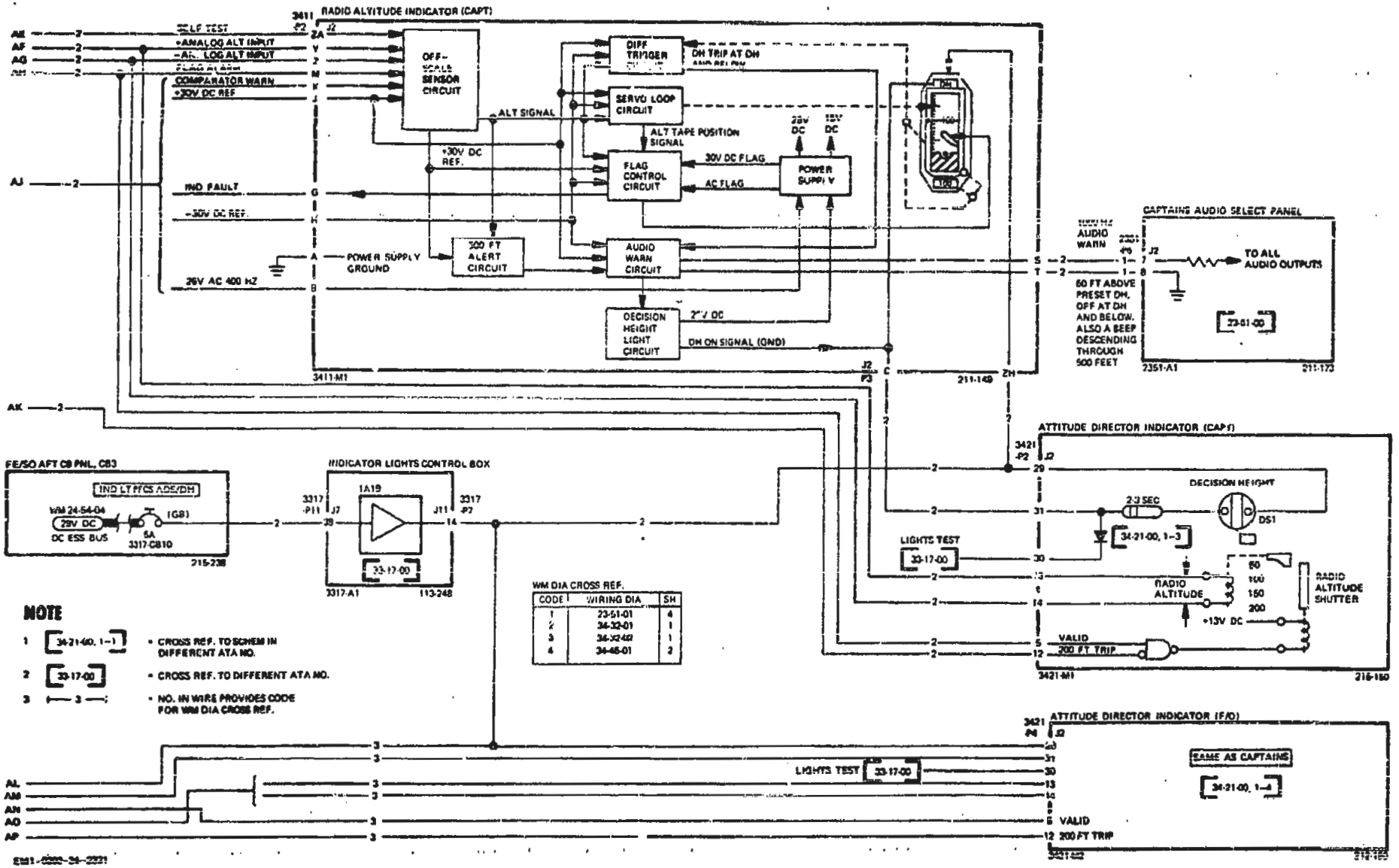
Radio Altimeter System Schematic
SCHEM 1 (Sheet 3)

R EFFECTIVITY: ALL
R
0018



Radio Altimeter System Schematic
SCHEM 1 (Sheet 2)

R
R
001B EFFECTIVITY: A/C WITH 860F-4 DIGITAL ALTIMETER



NOTE

1. [34-21-00, 1-1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. [33-17-00] - CROSS REF. TO DIFFERENT ATA NO.
3. —3— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	23-51-01	4
2	34-32-01	1
3	34-32-02	1
4	34-46-01	2

Radio Altimeter System Schematic
SCHEM 1 (Sheet 3)

R EFFECTIVITY: A/C WITH 860F-4 DIGITAL ALTIMETER
R
001B

RADIO ALTIMETER SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

23-43-00 Service Interphone System - Maintenance Practices

24-00-00 Electrical Power - Maintenance Practices

2. Equipment and Materials

Altimeter Test Set, P/N 137-34-329 (Collins 980N-1) or equivalent

Oscilloscope, TEK 323 or equivalent

NOTE: Test set and oscilloscope required to perform functional test(s).

3. Adjustment/Test

NOTE: Satisfactory performance of operational test (BITE, Step 3B) ascertains that receiver-transmitter(s) and radio altitude indicator(s) are operable. If antennas and cables are to be tested, or if more detailed testing of receiver-transmitters or radio altitude indicators is to be performed, procedures in functional test (Step 3C) should be performed.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, verify following circuit breakers are closed:

AUDIO CONTROL - CAPT & F/E (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

RADIO ALTM (D4)

RADIO ALTM (D22)

ILS (G4)

ILS (G22)

(2) On FE/SO overhead circuit breaker panel CB2, verify circuit breakers INSTR COOLING (A21) and GND SVCE INTPH (L1) are closed.

(3) On FE/SO aft circuit breaker panel CB3, verify following circuit breakers are closed:

AUDIO CONT - CAPT & F/E (C16)

AUDIO CONT - F/O & OBS (C17)

AUDIO CONT - FLT INPH AMPL (C18)

IND LT PFCS ADS/DH (G8)

(4) Turn aircraft electrical power ON (Ref. 24-00-00).

(5) On FE/SO-ECS MONITOR panel, ensure AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights are out.

(6) Establish communications between MESC and flight station as follows (Ref. 23-43-00):

(a) On MIC SELECTION panel under FE/SO table, connect service interphone handset to SERVICE INTERPHONE jack and press SERVICE INTERPHONE - ON switchlight, lighting ON legend.

(b) Connect service interphone handset to MESC service interphone jack located on galley door frame, half-way up on outboard edge, near service light switch, zone 137.

NOTE: Two men are required; one in MESC and flight station.

(7) Establish audio to Captains and F/Os flight station speakers and set desired volume.

CR B. BITE /Operational check

The BITE (self test) in the following steps is for Radio Altimeter No. 1 with Radio Altimeter No. 2 differences denoted in parenthesis

NOTE: The radio altitude indicators, with aircraft on landing gear, will indicate slightly below ground level (approximately - five feet). Indicator reading will not be less than zero feet if aircraft is on jacks or fuel tanks are empty.

(1) Perform procedures outlined in Step 3A.

NOTE: Cycle RADIO ALTM (D4) or (D22) circuit breaker on and off before proceeding to Step (2).

(2) Press and hold SELF TEST pushbutton switch on RT No. 1 (No. 2) in MESC.

NOTE: Verify R/T, IND, VSWR and X-CONN annunciators on RT No. 1 (No. 2) front panel are black.

(a) Captains (F/O) radio altimeter indicator:

Indicates 30 ±5-feet.

Flag in view.

(3) Release SELF TEST pushbutton switch on RT No. 1 (No. 2); radio altimeter indicator display must return to normal.

(4) If functional test(s) will not be performed; disconnect intercom setup between flight station and MESC and turn off aircraft electrical power (Ref. 24-00-00).

C. Radio Altimeter System Functional Test

NOTE: Ensure area underneath aircraft is free of obstructions and movement of metal objects does not occur during functional test.

(1) Perform procedures outlined in Step 3A.

R NOTE: Test is for either Radio Altimeter System, system No. 1 is shown with (2) and (F/O) following No. 1 and Captain throughout test.

(2) Remove cover from TEST connector on RT No. 1 (2) front panel and connect Altimeter Test Set 980N-1, or equivalent to TEST connector.

(3) On altimeter test set:

(a) Set TEST SELECT to 980N-1 SELF TEST:

C Check the following:

C All lamps (on 980N-1 tester) are ON except A/P
C WARN and NO WARN.

Meter pointer moves as ALTITUDE STANDARD potentiometer is rotated.

C Captains (F/O) radio altitude indicator indicates approximately 0-feet.

C Captains (F/O) ADI radio altitude scale indicates
C approximately 0-feet.

NOTE: Indicator reading will not be less than zero if aircraft is on jacks or fuel tanks are empty.

(4) Select an ILS frequency on Captain (F/O) VHF NAV control panel.

(5) On altimeter test set:

(a) Set TEST SELECT to AL-101 SELF TEST and observe:

All lamps must be OUT, except TRIP lamp. A/P WARN may or may not be ON.

C Captains (F/O) radio altitude indicator indicates
C approximately 30-feet, with Flag in view.

C Captains (F/O) ADI radio altitude is covered by
C shutter.

NOTE: DH lamps on radio altitude indicators and ADI, must not come ON if test altitude is above DH counter bug setting.

(6) On altimeter test set:

(a) Set TEST SELECT to AUX/IND ALTITUDE.

(b) Set AID/ALT SELECT to 480 FT/ST, adjust ALTITUDE STANDARD to zero meter.

NOTE: To zero meter, always begin with METER SENS switch to LOW POSITION. Adjust ALTITUDE STANDARD potentiometer to zero meter (pointer on mid-scale mark) with METER SENS switch first in LOW, then MED (for increased accuracy), and then HIGH (for best accuracy).

(c) Verify FLAG lamp is ON and ALTITUDE STANDARD indicates 480 ±10-feet.

(d) Captain (F/O) radio altitude indicator indicates 480 ±10-feet and flag must be out of view. DH lamp, see NOTE in Step 3C(5).

(7) On altimeter test set:

(a) Set TEST SELECT to A/P ALTITUDE AND TRIPS, adjust ALTITUDE STANDARD to zero meter [Ref. Step 3C(6)(b) NOTE].

(b) Repeat Steps 3C(6), (c) through (e). Results must be same as Steps 3C(6)(c) and (d).

(8) On altimeter test set:

(a) Set AID/ALT SELECT to VARIABLE.

(b) Set ALTITUDE TRIP SELECT to 2.

(c) Adjust ALTITUDE control until TRIP lamp goes OFF, readjust until TRIP lamp just comes on.

(d) Adjust ALTITUDE STANDARD potentiometer to zero meter pointer as outlined in Step 3C(6)(b) NOTE.

(e) Verify ALTITUDE STANDARD indicates 200 ±11-feet and Captain (F/O) radio altitude indicator indicates 200 ±15-feet.

(9) On altimeter test set:

(a) ALTITUDE TRIP SELECT to 8.

(b) Adjust ALTITUDE control until TRIP lamp goes OFF, readjust until TRIP lamp just comes ON.

(c) Adjust ALTITUDE STANDARD potentiometer to zero meter pointer as outlined in Step 3C(6)(b) NOTE.

(d) Verify ALTITUDE STANDARD indicates 2500-feet. Negative tolerance is 480-feet. Positive tolerance cannot be read on ALTITUDE STANDARD because it does not register beyond 2500-feet. If TRIP 8 operates above 2500-feet, but within range of ALTITUDE control, operation is satisfactory.

(e) Captain (F/O) radio altitude indicator must indicate 2500 + 0, -500-feet.

(10) On altimeter test set:

(a) Set AID/ALT SELECT to VARIABLE.

C (b) Adjust ALTITUDE control to maximum, decrease until
C 1000-Hz tone is heard for approximately 2-seconds
C in Captain (F/O) speaker.

C Tone must last approximately 2-seconds. System No. 1
C tone will be heard in Captains headset and System
C No. 2 in F/O headset.

C (c) Adjust ALTITUDE STANDARD to zero meter [(Ref. Step
C 3C(6)(b) NOTE].

C (d) ALTITUDE STANDARD must indicate 500 ±28-feet.

C (e) Captain (F/O) radio altitude indicator must
C indicate 500 ±30-feet.

C NOTE: If decision height setting on Captains
C (F/O) radio altitude indicator is above
C 425-feet, 500-foot audio alert circuit is
C disabled.

C (11) Set Captain (F/O) radio altitude indicator decision
C height to 100-feet and Press-To-Reset DH light if ON.

(12) On altimeter test set:

(a) Decrease ALTITUDE control to approximately 200-feet.

(b) Set TEST SELECT to AUX/IND ALTITUDE.

C (c) Decrease ALTITUDE control slowly until1000-Hz
C audio beeping signal is heard in Captains (F/O) speaker.

(d) Adjust ALTITUDE STANDARD potentiometer to zero meter as outlined in Step 3C(6)(b) NOTE.

(e) Record ALTITUDE STANDARD indication for later use.

(f) Verify Captain (F/O) radio altitude indicator indicates 150 (-3)(+10) feet and DH light is OUT.

(13) On altimeter test set:

C (a) Decrease ALTITUDE control until audio stops and
C Captains (F/O) ADI DH light comes on for
C approximately 2-seconds and radio altitude
C indicator DH light comes ON.

(b) Adjust ALTITUDE STANDARD potentiometer to zero meter as outlined in Step 3C(6)(b) NOTE.

(c) Verify ALTITUDE STANDARD indicates 100 ±6-feet. Subtract this indication from that noted in Step
C 3C (12)(e). Difference must be 50 ±4- feet.

Verify altitude shutter on ADI is retracted and pointer reads 100 ±25-feet.

(14) Adjust ALTITUDE control on test set until DH lamp on Captain (F/O) radio altitude indicator just comes ON.

R NOTE: If DH lamp is ON at start of this Step, increase
R ALTITUDE control until lamp goes OUT and then
R decrease until lamp comes ON.

(15) On altimeter test set:

(a) Adjust ALTITUDE STANDARD potentiometer to zero meter as outlined in Step 30(6)(b) NOTE.

(b) Verify ALTITUDE STANDARD indicates 100 ±5-feet.

C (16) Press and release DH light lens cap on Captain (F/O)
C radio altitude indicator.

C (a) DH light on Captain (F/O) radio altitude indicator
C and DH light on Captain (F/O) ADI must go OUT.

C (17) On pilots overhead circuit breaker panel CB1, open and
C tag circuit breaker RADIO ALTM (D22).

C (18)

C On altimeter test set:

(a) Set TEST SELECT to VSWR. NOTE: VSWR = Voltage Standing Wave Ratio

(b) With RCVR/SET/XMTR switch in SET, adjust SET infinity control until meter pointer is at infinity mark on VSWR meter scale.

(c) Set and hold RCVR/SET/XMTR switch to RCVR.

(d) Verify meter VSWR indication is less than 2.4 (1.3 nominal).

(e) Set and hold RCVR/SET/XMTR switch to XMTR.

(f) Verify meter VSWR indication is less than 2.4 (1.3 nominal).

(g) Release RCVR/SET/XMTR switch.

C (19) Set TEST SELECT to OFF on altimeter test set.

C (20) On pilots overhead circuit breaker panel CB1, open and C tag circuit breaker RADIO ALTM (D4).

C (21) Disconnect altimeter test set from TEST connector on RT C No. 1 front panel.

C (22) Connect altimeter test set to TEST connector on RT No. 2 C front panel.

C (23) On pilots overhead circuit breaker panel CB1, energize C circuit breaker (D22).

C (24) Repeat Steps 3C(18)(a) thru (g).

C (25) Connect oscilloscope power input cable to 115-V ac, C 400-Hz SERVICE OUTLET in MESC.

C (26) Connect oscilloscope vertical input to pin U of TEST C connector on RT No. 1 (2) front panel.

C (27) Remove cover and connect oscilloscope horizontal input C to pin U of TEST connector on RT No. 2 (1) front panel.

C (28) Remove tags and engage RADIO ALTM circuit breakers (D4) C and (D22) on pilots overhead circuit breaker panel CB1.

C (29) Turn on oscilloscope and adjust controls to observe C 180-degree phase shift between RT No. 1 and RT No. 2.

C NOTE: Correct indication is an ellipse tilted C approximately 45-degrees from upper left to C lower right corner of oscilloscope display.

(30) Verify all maintenance monitors on both RT units show black. Press RESET button as required to clear any faulted monitor except RT, which requires use of a magnet. Verify for 15-seconds that all monitors remain black after reset.

(31) Verify both radio altitude indicators show less than zero, and flag is out of view.

NOTE: Indicator reading will not be less than zero if aircraft is on jacks or fuel tanks are empty.

(32) Press SELF-TEST switch on front panel of RT No. 1 (2).

(33) Disengage NO. 1 RADIO ALTM (D4) circuit breaker only.

(34) Press SELF-TEST switch on front panel of RT No. 1. There must be an indication of less than zero and flag must be in view.

NOTE: See Note in Step 3B.

(35) Disengage NO. 2 RADIO ALTM (D22) circuit breaker only.

(36) Press SELF-TEST switch on front panel of RT No. 2. There must be an indication of less than zero, and flag must be in view.

NOTE: See Note in Step 3B.

(37) Turn off and disconnect oscilloscope.

(38) Replace covers on both RT front panel TEST connectors.

(39) Remove tags and close circuit breakers opened in Steps 3C(33) and 3C(35).

(40) Disconnect intercom setup between flight station and MESC (Ref. 23-43-00).

(41) Turn aircraft electrical power OFF (Ref. 24-00-00).

RADIO ALTIMETER SYSTEM - ADJUSTMENT AND TEST

NOTE: The 860F-4 Digital Altimeter may or may not be used in your fleet. However, the o60F-1 analog altimeter is no longer being manufactured. This procedure is being added to take care of this possibility. They are directly interchangeable.

1. Referenced Procedures

23-43-00 Service Interphone System - Maintenance Practices

24-00-00 Electrical Power - Maintenance Practices

2. Equipment and Materials

R Altimeter Test Set, P/N 137-34-329 (Collins 980N-1) or equivalent

Aluminum Stock large enough to cover the four Radio Altimeter Antennas

Tape to attach aluminum cover over antennas.

3. Adjustment/Test

NOTE: Satisfactory performance of operational test (BITE, Step 3B) ascertains that receiver-transmitter(s) and radio altitude indicator(s) are operable. If antennas and cables are to be tested, or if more detailed testing of receiver-transmitters or radio altitude indicators is to be performed, procedures in functional test(Steps 3C, 3D and 3E) should be performed.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, verify following circuit breakers are closed:

AUDIO CONTROL - CAPT & F/E (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

RADIO ALTM (D4)

RADIO ALTM (D22)

ILS (G4)

ILS (G22)

(2) On FE/SO overhead circuit breaker panel CB2, verify circuit breakers INSTR COOLING (A21) and GND SVCE INTPH (L1) are closed.

(3) On FE/SO aft circuit breaker panel CB3, verify following circuit breakers are closed:

AUDIO CONT - CAPT & F/E (C16)

R AUDIO CONT - F/O, OBS & FESC (C17)

AUDIO CONT - FLT INPH AMPL (C18)

IND LT PFDS ADS/DH (G8)

(4) Turn aircraft electrical power ON (Ref. 24-00-00).

(5) On FE/SO-ECS MONITOR panel, ensure AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights are out.

(6) Establish communications between MESC and flight station as follows (Ref. 23-43-00):

(a) On MIC SELECTION panel under FE/SO table, connect service interphone handset to SERVICE INTERPHONE jack and press SERVICE INTERPHONE - ON switchlight, lighting ON legend.

(b) Connect service interphone handset to MESC service interphone jack located on galley door frame, half-way up on outboard edge, near service light switch, zone 137.

NOTE: Two men are required; one in MESC and flight station.

(7) Establish audio to Captains and F/Os flight station speakers and set desired volume.

C B. BITE /Operational check

The BITE (self test) in the following steps is for Radio Altimeter No. 1 with Radio Altimeter No. 2 differences denoted in parenthesis

R NOTE: The radio altitude indicators, with aircraft on
R landing gear, will indicate slightly below ground
R level (approximately - five feet). Indicator reading
R will not be less than zero feet if aircraft is on
R jacks or fuel tanks are empty.

R (1) Perform procedures outlined in Step 3A.

R NOTE: Cycle RADIO ALTM (D4) or (D22) circuit breaker
R on and off before proceeding to Step (2).

R (2) Press and hold SELF TEST pushbutton switch on RT No. 1
R (No. 2) in MESC.

R (a) Captains (F/O) radio altimeter indicator:

R Indicates 30 ±5-feet.

R Flag in view.

R (3) Release SELF TEST pushbutton switch on RT No. 1 (No.
R 2); radio altimeter indicator display must return to
R normal.

R (4) If functional test(s) will not be performed; disconnect
R intercom setup between flight station and MESC and turn
R off aircraft electrical power (Ref. 24-00-00).

R C. Radio Altimeter System Functional Test

R NOTE: Ensure area underneath aircraft is free of
R obstructions and movement of metal objects does not
R occur during functional test.

R (1) Perform procedures outlined in Step 3A.

R NOTE: Test is for either Radio Altimeter System,
R systemNo. 1 is shown with (2) and (F/O)
R following No. 1 and Captain throughout test.

R (2) Remove cover from TEST connector on RT No. 1 (2) front
R panel and connect Altimeter Test Set 980N-1, or
R equivalent to TEST connector.

R (3) On altimeter test set:

R (a) Set TEST SELECT to 980N-1 SELF TEST:

CR Check the following:

CR All lamps (on 980N-1 tester) are ON except A/P
CR WARN and NO WARN.

R Meter pointer moves as ALTITUDE STANDARD
R potentiometer is rotated.

R Captains (F/O) radio altitude indicator indicates
CR approximately 0-feet.

CR Captains (F/O) ADI radio altitude scale indicates
CR approximately 0-feet.

R NOTE: Indicator reading will not be less than
R zero if aircraft is on jacks or fuel tanks
R are empty.

R (4) Select an ILS frequency on Captain (F/O) VHF NAV
R control panel.

R (5) On altimeter test set:

R (a) Set TEST SELECT to AL-101 SELF TEST and observe:

R All lamps must be OUT, except TRIP lamp. A/P WARN
R may or may not be ON.

CR Captains (F/O) radio altitude indicator indicates
CR approximately 30-feet, with Flag in view.

CR Captains (F/O) ADI radio altitude is covered by
CR shutter.

R NOTE: DH lamps on radio altitude indicators and
R ADI, must not come ON if test altitude is
R above DH counter bug setting.

R (6) On altimeter test set:

R (a) Set TEST SELECT to AUX/IND ALTITUDE.

R (b) Set AID/ALT SELECT to 480 FT/57, adjust ALTITUDE
R STANDARD to zero meter.

R NOTE: To zero meter, always begin with METER SENS
R switch to LOW POSITION. Adjust ALTITUDE
R STANDARD potentiometer to zero meter
R (pointer on mid-scale mark) with METER SENS
R switch first in LOW, then MED (for
R increased accuracy), and then HIGH (for
R best accuracy).

R (c) Verify FLAG lamp is ON and ALTITUDE STANDARD
R indicates 480 ±10-feet.

R (d) Captain (F/O) radio altitude indicator indicates
R 480 ±10-feet and flag must be out of view. DH
R lamp, see NOTE in Step 3C(5).

R (7) On altimeter test set:

R (a) Set TEST SELECT to A/P ALTITUDE AND TRIPS, adjust
R ALTITUDE STANDARD to zero meter [Ref. Step
R 3C(6)(b) NOTE].

R (b) Repeat Steps 3C(6), (c) through (e). Results must
R be same as Steps 3C(6)(c) and (d).

R (8) On altimeter test set:

R (a) Set AID/ALT SELECT to VARIABLE.

R (b) Set ALTITUDE TRIP SELECT to 2.

R (c) Adjust ALTITUDE control until TRIP lamp goes OFF,
R readjust until TRIP lamp just comes on.

R (d) Adjust ALTITUDE STANDARD potentiometer to zero
R meter pointer as outlined in Step 3C(6)(b) NOTE.

R (e) Verify ALTITUDE STANDARD indicates 200 ±11-feet
R and Captain (F/O) radio altitude indicator
R indicates 200 ±15-feet.

R (9) On altimeter test set:

R (a) ALTITUDE TRIP SELECT to 8.

R (b) Adjust ALTITUDE control until TRIP lamp goes OFF,
R readjust until TRIP lamp just comes ON.

R (c) Adjust ALTITUDE STANDARD potentiometer to zero
R meter pointer as outlined in Step 3C(6)(b) NOTE.

R (d) Verify ALTITUDE STANDARD indicates 2500-feet.
R Negative tolerance is 480-feet. Positive
R tolerance cannot be read on ALTITUDE STANDARD
R because it does not register beyond 2500-feet. If
R TRIP 8 operates above 2500-feet, but within range
R of ALTITUDE control, operation is satisfactory.

R (e) Captain (F/O) radio altitude indicator must
R indicate 2500 + 0, -500-feet.

R (10) On altimeter test set:

R (a) Set AID/ALT SELECT to VARIABLE.

CR (b) Adjust ALTITUDE control to maximum, decrease until
CR 1000-Hz tone is heard for approximately 2-seconds
CR in Captain (F/O) speaker.

CR Tone must last approximately 2-seconds. System No. 1
CR tone will be heard in Captains headset and System
CR No. 2 in F/O headset.

CR (c) Adjust ALTITUDE STANDARD to zero meter [(Ref. Step
CR 3C(6)(b) NOTE].

CR (d) ALTITUDE STANDARD must indicate 500 ±28-feet.

CR (e) Captain (F/O) radio altitude indicator must
CR indicate 500 ±30-feet.

CR NOTE: If decision height setting on Captains
CR (F/O) radio altitude indicator is above
CR 425-feet, 500-foot audio alert circuit is
CR disabled.

CR (11) Set Captain (F/O) radio altitude indicator decision
CR height to 100-feet and Press-To-Reset DH light if ON.

R (12) On altimeter test set:

R (a) Decrease ALTITUDE control to approximately
R 200-feet.

R (b) Set TEST SELECT to AUX/IND ALTITUDE.

CR (c) Decrease ALTITUDE control slowly until1000-Hz
CR audio beeping signal is heard in Captains (F/O)
R speaker.

R (d) Adjust ALTITUDE STANDARD potentiometer to zero
R meter as outlined in Step 3C(6)(b) NOTE.

R (e) Record ALTITUDE STANDARD indication for later use.

R (f) Verify Captain (F/O) radio altitude indicator
R indicates 150 (-3)(+10) feet and DH light is OUT.

R (13) On altimeter test set:

CR (a) Decrease ALTITUDE control until audio stops and
CR Captains (F/O) ADI DH light comes on for
CR approximately 2-seconds and radio altitude
CR indicator DH light comes ON.

R (b) Adjust ALTITUDE STANDARD potentiometer to zero
R meter as outlined in Step 3C(6)(b) NOTE.

(c) Verify ALTITUDE STANDARD indicates 100 ±6-feet. Subtract this indication from that noted in Step 3C (12)(e). Difference must be 50 ±4- feet.

Verify altitude shutter on ADI is retracted and pointer reads 100 ±25-feet.

(14) Adjust ALTITUDE control on test set until DH lamp on Captain (F/O) radio altitude indicator just comes ON.

NOTE: If DH lamp is ON at start of this Step increase ALTITUDE control until lamp goes OUT and then decrease until lamp comes ON.

(15) On altimeter test set:

(a) Adjust ALTITUDE STANDARD potentiometer to zero meter as outlined in Step 3C(6)(b) NOTE.

(b) Verify ALTITUDE STANDARD indicates 100 ±5-feet.

(16) Press and release DH light lens cap on Captain (F/O) radio altitude indicator.

(a) DH light on Captain (F/O) radio altitude indicator and DH light on Captain (F/O) ADI must goOUT.

(17) Set TEST SELECT switch on test set to OFF.

(a) Remove power from Systems No. 1 and No. 2 by pulling out CBs (D4) and (D22).

(b) Disconnect test set from RT unit, rollup cable assembly and stow in top of test set.

(18) Verify both radio altitude indicators show less than zero, and flag is out of view.

NOTE: Indicator reading will not be less than zero if aircraft is on jacks or fuel tanks are empty.

(19) Press SELF-TEST switch on front panel of RT No. 1 (2). Radio altitude must indicate 30 ±5-feet and flag must be in view.

D. Radio Altimeter Transmission Line Check

(1) Cover all four Radio Altimeter Antennas by placing a piece of aluminum stock over antennas and taping to fuselage.

NOTE: Radio Altimeter Transmit Antennas are located forward of Radio Altimeter Receive Antennas and aft of VHF No. 2 Blade Antenna. Approximate location for Radio Altimeter No. 1 Transmit Antenna is LBL29.46, No. 2 Antenna is RBL 29.46.

(2) Verify indicated altitude on both Radio Altitude Indicators is above 2500-feet.

(3) Remove aluminum stock (covers) and tape from all four Radio Altimeter Antennas.

E. Test Completion

(1) Disengage NO. 1 RADIO ALTM (D4) circuit breaker only.

(2) Press SELF-TEST switch on front panel of RT No. 1. There must be an indication of less than zero and flag must be in view.

NOTE: See Note in Step 3B.

(3) Disengage NO. 2 RADIO ALTM (D22) circuit breaker only.

(4) Press SELF-TEST switch on front panel of RT No. 2. There must be an indication of less than zero, and flag must be in view.

NOTE: See Note in Step 3B.

R (5) Replace covers on both RT front panel TEST connectors.

R (6) Remove tags and close circuit breakers opened in Steps
R 3E(1) and 3E(3).

R (7) Disconnect intercom setup between flight station and
R MESC (Ref. 23-43-00).

R (8) Turn aircraft electrical power OFF (Ref. 23-43-00).

RADIO ALTIMETER RECEIVER-TRANSMITTER REMOVAL AND INSTALLATION

1. Referenced Procedures

34-32-00 Radio Altimeter System - Adjustment and Test

R NOTE: Radio Altimeter Receiver - Transmitter Part No.
R 522-3698-011 modified by Collins Service Bulletin 59, and production units Serial No. 11607 and up, which have Service Bulletin 59 incorporated, have shown a remote possibility of going to the self-test mode without warning flags. This provides a sudden 30-foot radio altimeter output with no warning signals to using equipment. This characteristic affects the radio altimeter indicator and use of the auto-throttles and autopilot Approach Land (A/L) mode for approach and landing. Under these conditions, the autopilot Approach/Land (A/L) mode for coupled approach and landing and the automatic throttles during approach are not to be used.

R If the radio altimeter receiver-transmitter does not have Collins Service Bulletin 59 installed, the operator has the option of installing Service Bulletin 61.

R If any Lockheed Part No. radio altimeter receiver-transmitter has Collins Service Bulletin 59 incorporated, no spare receiver-transmitter without Collins Service Bulletin 59 is available, and the aircraft is to be flown, it is recommended that a typewriter placard be installed in the Flight Station adjacent to the Glareshield Panel for both Captain and First Officer which indicates:

WARNING:
- DO NOT USE THE AUTOPILOT APPROACH LAND (A/L) MODE FOR COUPLED APPROACH AND LANDING
- DO NOT USE AUTOMATIC THROTTLES DURING APPROACH

NOTE: Incorporation of Collins Service Bulletin 61 into receiver-transmitters having Collins Service Bulletin 59 installed is to be accomplished during a program negotiated between the operator and the supplier.

Upon replacement of the radio altimeter receiver-transmitter with a Lockheed Part No. 671797 -111 having Collins Service Bulletin 61 installed, remove the Captains and First Officers WARNING placards from the flight station, if they were installed.

R NOTE: This modification was incorporated prior to delivery of
R the following aircraft: 032-999.

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION - RADIO ALTM (D4) or NO. 2 NAVIGATION - RADIO ALTM (D22).

(2) Enter mid electrical service center, zone 137 through galley or through access doors 192N and 137AZ.

(3) Locate radio altimeter receiver-transmitter No. 1 in left-hand equipment rack, shelf 1. Locate radio altimeter receiver-transmitter No. 2 in right-hand equipment rack, shelf 1, (Ref. Fig. 401).

(4) Loosen and disengage knobs securing radio altimeter receiver-transmitter No. 1 or No. 2 to mount.

(5) Pull radio altimeter receiver-transmitter forward until rear connectors are disengaged from mating connectors. Remove receiver-transmitter from mount.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) are open and tagged.

(2) Position radio altimeter receiver-transmitter on mount, aligning rear connectors and mating connectors. Push into place.

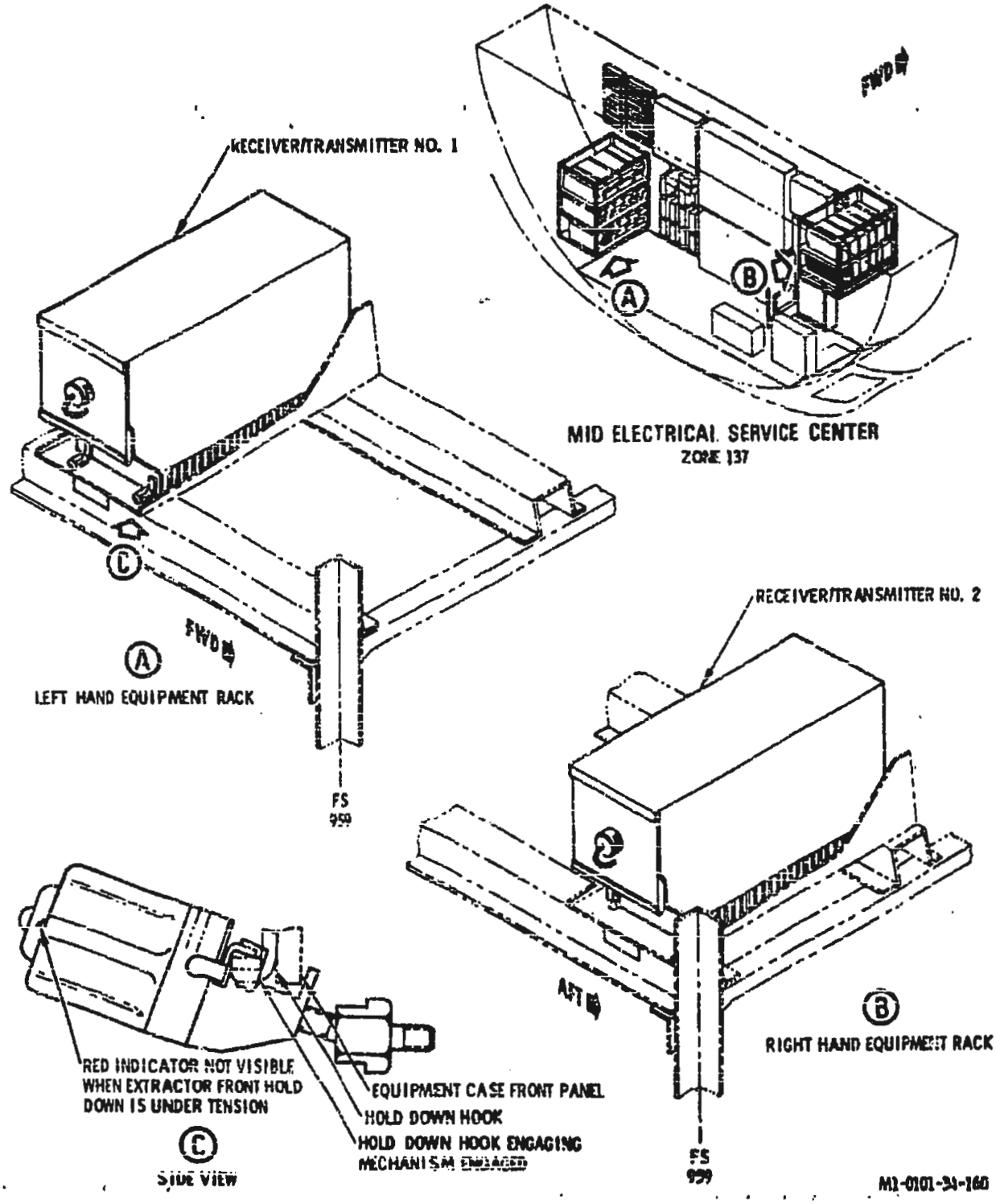
(3) Place mount holddown clamps over radio altimeter receiver-transmitter hooks.

(4) Tighten knobs securing receiver-transmitter to mount.

(5) Remove tags and close circuit breakers opened in Step 2A(1).

(6) Perform applicable (No. 1, or No. 2) radio altimeter system operational check (Ref. 34-32-00).

(7) If access to mid electrical service center was gained through access doors 192N and 137AZ, close and secure access doors.



Radio Altimeter Receiver-Transmitter - Removal and Installation
Figure 401

R
R
001B EFFECTIVITY: ALL

RADIO ALTIMETER ANTENNA - REMOVAL AND INSTALLATION

C 1. Bonding

C A. Improper bonding between radio altimeter antennas and
C airframe will cause system to malfunction. To detect
C improper bonding of transmitting or receiving antenna:

C (1) Using a Shallcross Bonding Meter (R & R 90190) check
C bonding resistance between radio altimeter antenna
C mounting flange and adjacent aircraft skin. Resistance
C must not exceed .005 ohm.

2. Equipment and Materials

Soft clean cloth

Gloves, disposable, MIL-G-36281, or equivalent

Plastic scraper

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

Solvent, Toluene TT-T-548, or equivalent

Teflon Tape, MIL-I-23594B, or equivalent

Tie-cord

R Anti-corrosion compound, LPS-3, or equivalent

R Shallcross Bonding Meter, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279), Mfr P/N PR 1436G-B2, TWA Stk Nbr
C 50-1188)

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers No. 1 NAVIGATION - RADIO ALTM (D4) or No. 2 NAVIGATION - RADIO ALTM (D22).

(2) Locate four radio altimeter antennas in area below wing center section box, zone 142, (Ref. Fig. 401).

(3) Remove screws securing radio altimeter antenna to bottom of fuselage, FS 1053 or FS 1013, zone 142.

(4) Lower radio altimeter antenna for access to coaxial cable.

(5) Remove tie-cord and teflon tape, then disconnect and cap coaxial connector.

(6) Remove radio altimeter antenna.

WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

KEEP MEK AWAY FROM HEAT, SPARKS AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

C (7) Use plastic scraper to remove sealant from fuselage
C structure. Use soft clean rag moistened with
C methyl-ethyl-keytone solvent, wipe fuselage structure
C clean.

B. Installation

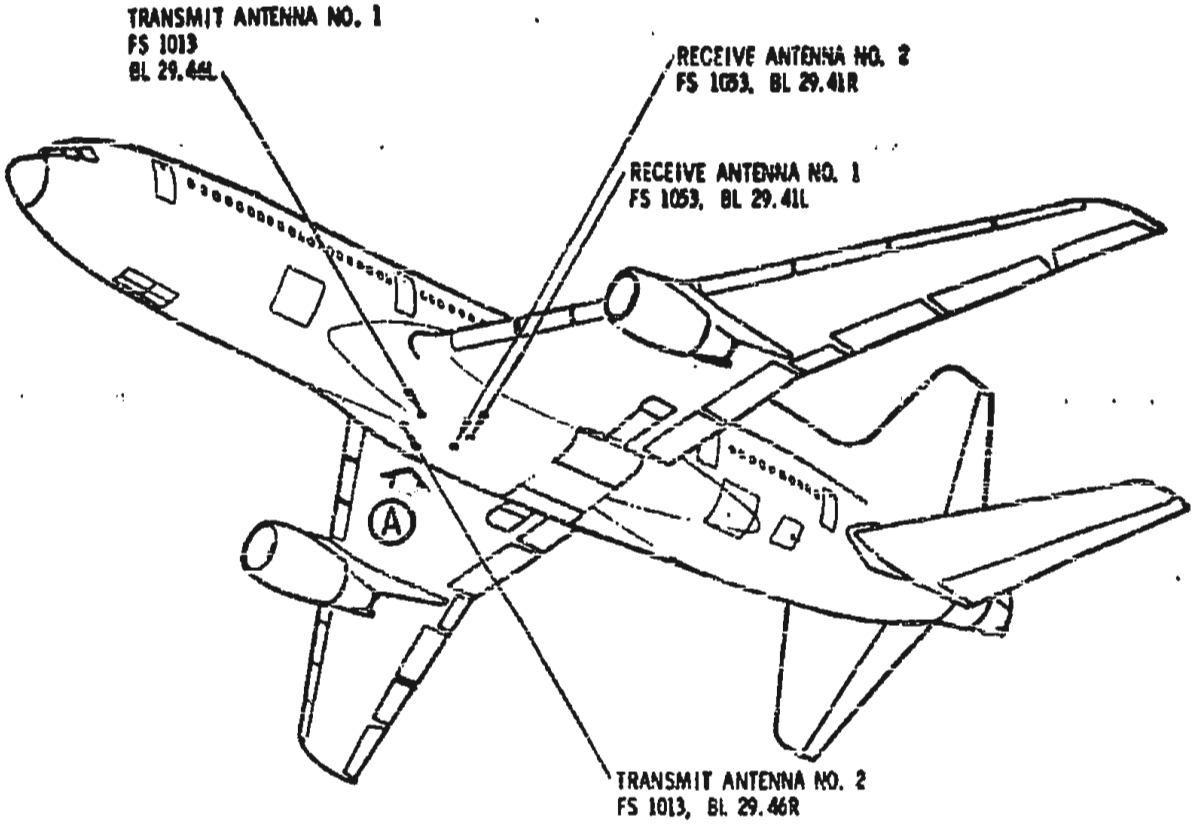
(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

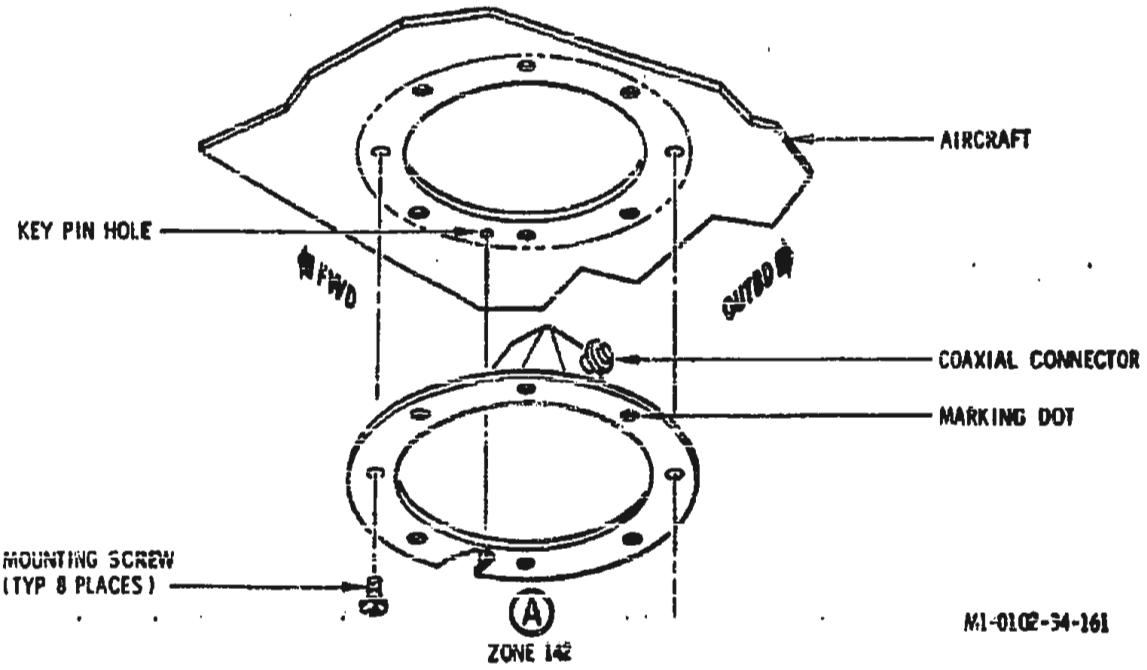
WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

C (2) Use clean soft rag moistened with trichloroethane
C solvent to clean faying surfaces of fuselage skin and
C antenna mounting plate. Before cleaning solvent dries,
C wipe dry with clean rag.

C (3) Connect radio altimeter cable to antenna. Spray
C fuselage and antenna mating surfaces with LPS-3
C anti-corrosion compound. If chromate primer is
C present, remove with a clean cloth moistened with MEK.
C Wipe dry. Do not allow to air-dry.

CR (4) Clean the external surfaces of the antenna connector
CR with Toluene Solvent, or equivalent. (5) Wrap
CR connector with a minimum of two layers of Teflon Tape,





Radio Altimeter Antenna - Removal and Installation
Figure 401

CR using slight tension on tape during wrapping process.
CR Apply last layer of tape with no tension, then secure
CR in place with tie cord.

CR (6) Position radio altimeter antenna, aligning holes on
CR mounting plate and fuselage. Install and tighten
CR screws securing radio altimeter antenna to bottom of
CR fuselage.

C NOTE: Before applying aerodynamic sealant, remove
C LPS-3 corrosion inhibited from area to be sealed
C as it may prevent adherence of sealant.

C WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES.
C PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE
C IRRITATION.

CR (7) Apply continuous sealant fillet between antenna
C mounting plate and fuselage using Environmental
C Sealant, LAC Spec C-40-1279 or PR1436GB2 (50 - 1188) or
C EC1547 (50 - 0631).

CR (8) Verify antenna bonding resistance does not exceed .005
C ohm. (See Para. 1 this procedure.)

CR (9) Remove tags and close circuit breakers opened in Step
C 2B(1).

C (10) Verify VSWR FIM annunciator on 860F-1 radio altimeter
C shows black. The 860F-4 radio altimeter has no VSWR
annunciator.

CR

L.R.R.A. ANTENNAS - ADJUSTMENT TEST - VSWR

C 1. General

C A. These tests are to be performed when LLRA system performance C and/or trouble shooting indicates the antenna system may be C malfunctioning.

C B, The area of the antennas must be free of obstructions or C equipment that could affect the test.

C 2. Antenna Voltage Standing Ratio (VSWR) Test.

C A. Equipment Required

C (1) Collins 980N-() L.R.R.A. tester, R&R 90202.

C (2) Cable Analyzer, R&R 90189.

C B. Test antenna system VWSR.

C (1) Pull the circuit breaker for the system under test.

C (2) Connect the R&R 90202 tester to the front panel C connector of the unit under test.

C (3) Reactivate the circuit breaker for the system under C test.

C (4) VSWR tests.

C (a) General

C 1) In these steps the VSWR on the receive and C transmit antenna cables is tested. Addition of C two (or more) VSWR'S is usually meaningless; in C this test, however, addition provides a convenient C means of evaluating the results.

C 2) The sum of the VSWR'S on both cables (transmit C cable and receive cable) must be no greater than C 4.8 nor less than 2.8, and a total VSWR between C 4.0 and 4.8 is questionalbe. For individual C cables, the nominal VSWR is 1.7; in no case can a C VSWR greater than 3.0 nor less than 1.4 be C tolerated, and an individual VSWR between 2.4 and C 3.0 is questionable.

CR For example: A VSWR of 2.1 on each cable,
CR which results in a total of 4.2 is acceptable
CR even though it is greater than 4.0. However,
CR one VSWR of 2.5 and the other 1.7, which still
CR results in a total of 4.2, should be
CR corrected.

CR 3) Any deviation from the nominal 1.7 is an
CR indication of one or more of the following
CR conditions:

CR a) Improper antenna-cable-connector
CR installation, either at the 860F-1 rear
CR connector, or at the antenna, or both.

CR b) Poor cable condition; poor shielding,
CR jacket worn so that shielding is exposed,
CR sharp bends in cable so that shielding
CR buckles, cracked or broken dielectric within
CR the cable.

CR c) Damaged antenna.

CR d) Improper tuning stub adjustment in the
CR 860F-1.

CR NOTE: In multisystem installations, it is
CR important that only the system under test
CR be energized when making VSWR tests.

CR (b) Perform VSWR test.

Tester set up	Results
TEST SELECT: VSWR	
RCVR-SET-XMTR: SET	
SET oo: adjust for indication on VSWR scale	
TEST SELECT: VSWR;	

Tester set up	Results
RCVR-SET-XMTR: RCVR (hold).	Observe VSWR and refer to general section above. Flex antenna coaxial cable at R/T and at antenna. Reading should not change.
TEST SELECT: VSWR	
RCVR-SET-XMTR: XMTR (hold).	Observe VSWR and refer to general section above. Flex antenna coaxial cable at R/T and at antenna. Reading should not change.

(c) If the coaxial cable appears faulty, check it with the R&R 90189 cable analyzer (See Chapter 23) and make corrections as required.

(d) If the antenna proves to be faulty, change it and repeat the VSWR tests.

(5) Pull the circuit breaker for the system under test, disconnect the tester and reset the circuit breaker.

(6) Perform a self-test of the L.R.R.A. system disturbed.

CR RADIO ALTITUDE INDICATOR - MAINTENANCE PRACTICES

CR 1. Radio Altimeter Indicator DH Lamp Replacement

CR CAUTION: THE USE OF EXCESSIVE FORCE WHEN REMOVING THE DH LIGHT
CR CAP CAN CAUSE DAMAGE TO THE CAP AND INDICATOR. THE RA
CR INDICATOR SHOULD BE REPLACED IF THE DH LIGHT CAP
CR CANNOT BE REMOVED WITHOUT USING EXCESSIVE FORCE.

CR A. Pull the DH light cap straight out the front of the RA
CR Indicator.

CR B. Rotate the contact bar 90° away from the lamps.

CR C. Remove the lamps from the DH light cap and replace them.

CR D. Reinstall in reverse order.

CR E. The DH lamp is a manufacturer part number CM6839, TWA Stk.
CR Nbr. 41-5861.

RADIO ALTITUDE INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

   34-32-00 Radio Altimeter System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers: NO. 1 NAVIGATION - RADIO ALTM (D4) or NO. 2 NAVIGATION - RADIO ALTM (D22) and 5 VAC INSTRUMENT LIGHTING - CAPT R (L21) or F/O R (L25)

      (2) Locate radio altitude indicator on Captains instrument panel, zone 211, and on First Officers instrument panel, zone 212, (Ref. Fig. 401).

      (3) Loosen clamp screws securing radio altitude indicator to Captains or First Officers instrument panel.

      (4) Pull radio altitude indicator out of recess in Captains or First Officers instrument panel and disconnect rear connector from mating connector.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

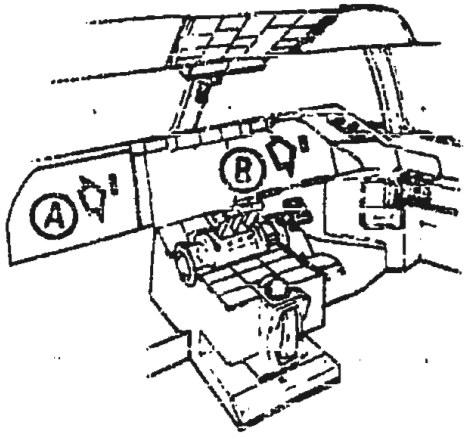
      (2) Connect rear connector on indicator to mating connector.

R R (3) Place radio altitude indicator into recess on Captains or First Officers instrument panel.

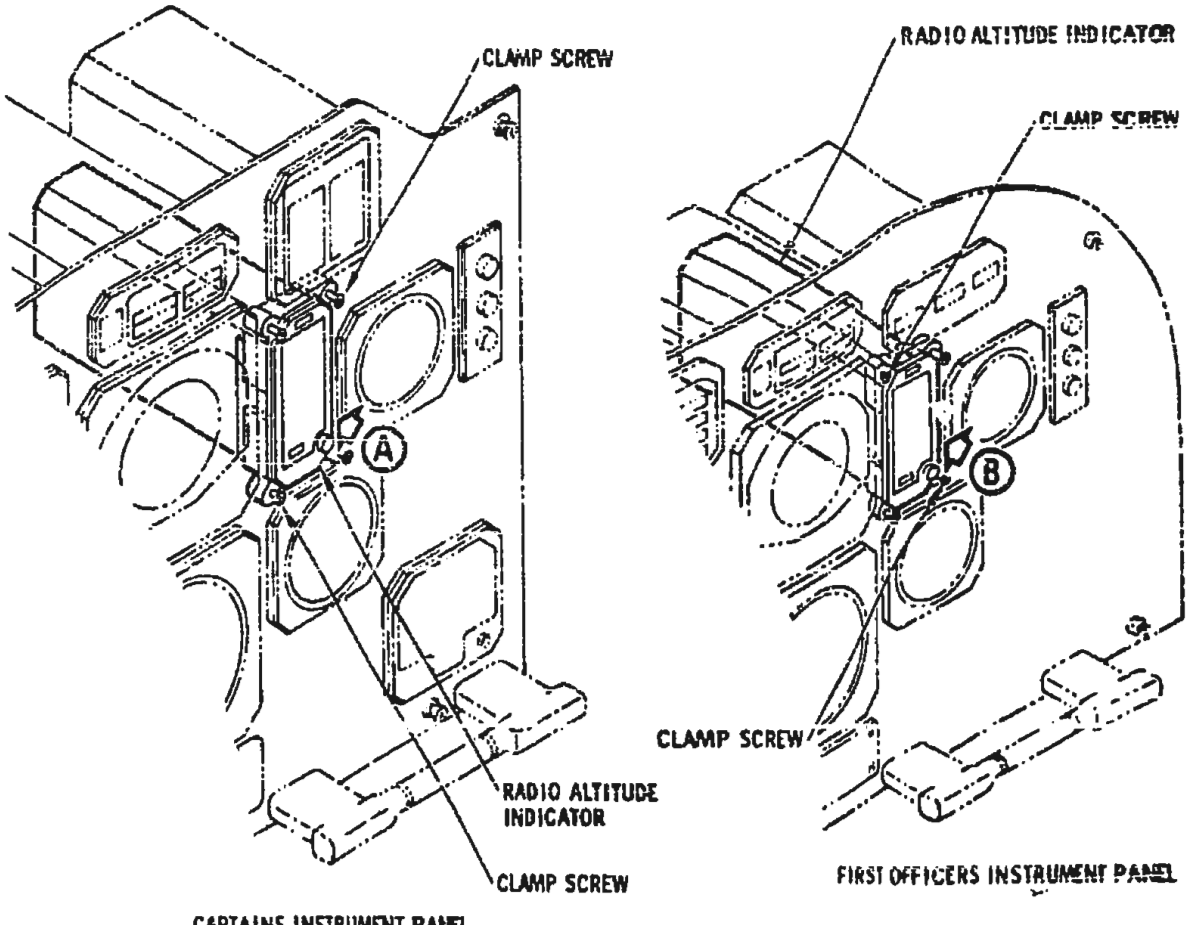
R R (4) On face of instrument panel, torque clamp adjusting screws to 5 to 8 lb in.

R R (5) Remove tags and close circuit breakers opened in Step 2A(1).

R R (6) Perform radio altimeter system BITE test (Ref. 34-32-00).



FLIGHT STATION
ZONE 211



Radio Altitude Indicator - Removal and Installation
Figure 401

INSTRUMENT LANDING SYSTEM (ILS) - DESCRIPTION AND OPERATION

1. General

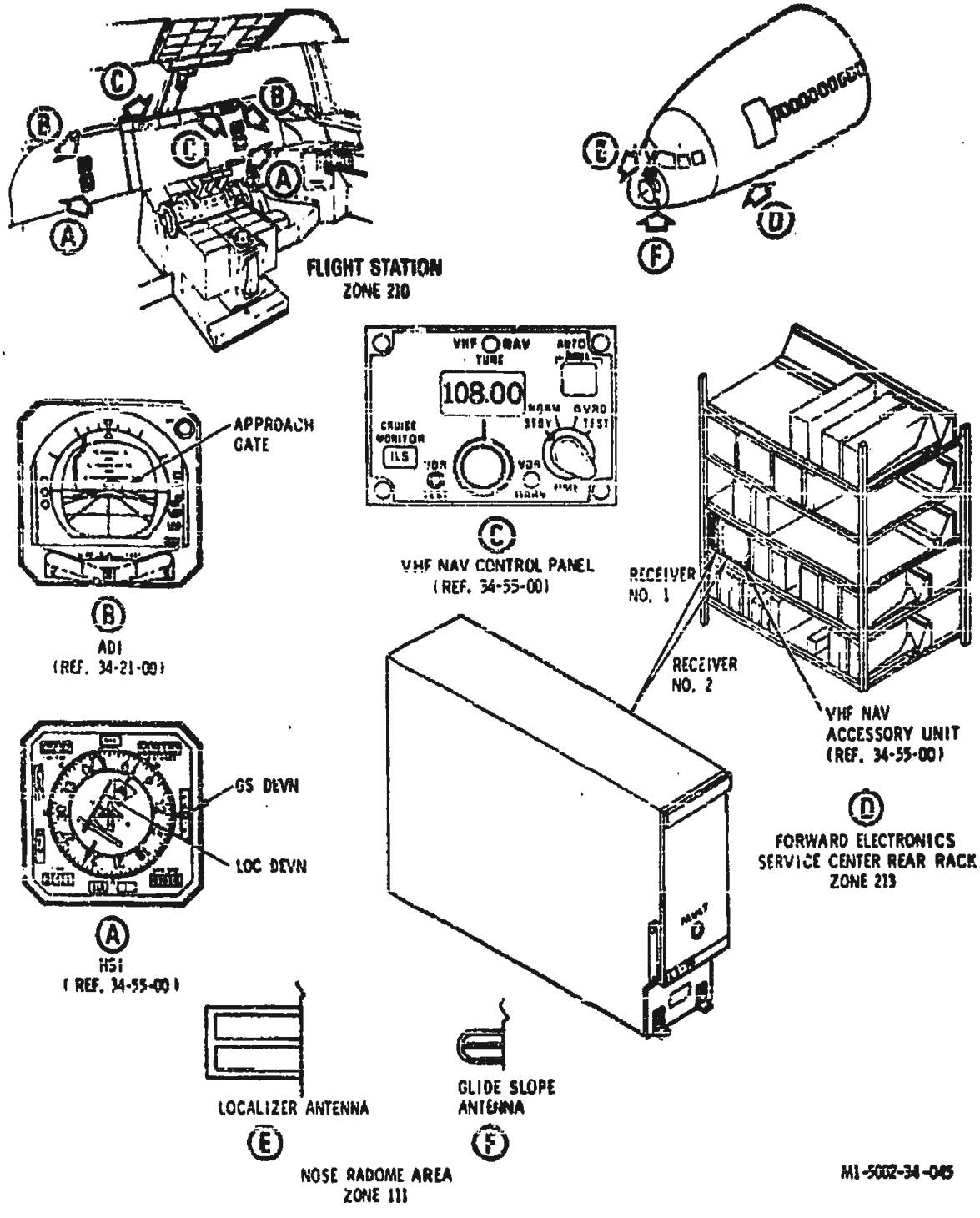
The instrument landing system (ILS) receives localizer and glideslope signals from ground station antennas located at the approach to a runway. The system processes the signals and provides outputs to operate deviation displays, and flag circuits in the attitude director indicator (ADI) and the horizontal situation indicator (HSI). System localizer and glideslope deviation outputs are also supplied to the autopilot (AFCS) to generate flight director command signals for control of the aircraft during automatic landing (AUTOLAND) (Ref. 22-00-00) and to the Flight Recorder (Ref. 31-31-00).

R Glideslope deviation is also supplied to the GPWS (Ref.
R 34-15-00). Two systems are installed on the aircraft. Each system (Ref. Fig. 1) consists of a receiver, part of the VHF NAV accessory unit, a dual glideslope antenna, a dual localizer antenna, part of the pilots ADI and HSI indicator displays and part of the VHF NAV control panel functions. System No. 1 is controlled by the Captains VHF NAV control panel and drives the Captains ADI and HSI ILS displays. System No. 2 is controlled by the First Officers VHF NAV control panel and drives the First Officers ADI and HSI ILS displays.

When the alternate deviation (ALTN DEV) switchlight on the applicable INSTRUMENT SOURCE SELECT panel (Ref. 34-00-01) is depressed; the HSI ILS display will be driven by the other receiver, ie; system No. 1 information displayed on both HSI, or system No. 2 information displayed on both HSI. The ADI, AFCS, and ground proximity warning system (GPWS) information is not switched.

The receivers and the VHF NAV accessory unit (Ref. 34-55-00) are located in the forward electronics service center, rear avionics rack, zone 113. The antennas are located in the radome, zone 111. The indicator display functions are part of the ADI (Ref. 34-21-00) and HSI (Ref. 34-55-00) located on the Captains and First Officers instrument panels, zones 211 and 212. The control functions are selected on the VHF NAV control panels (Ref. 34-55-00) located in the pilots glareshield panels, zones 211 and 212.

The system receives 40 very high frequency (VHF) localizer channels in the frequency range of 108.10 to 111.95-MHz and 40 corresponding ultra high frequency (UHF) glideslope channels in the frequency range of 329.15 to 335.00-MHz (Ref. Table 1).



R
R

Instrument Landing System
Figure 1

EFFECTIVITY: ALL

001B

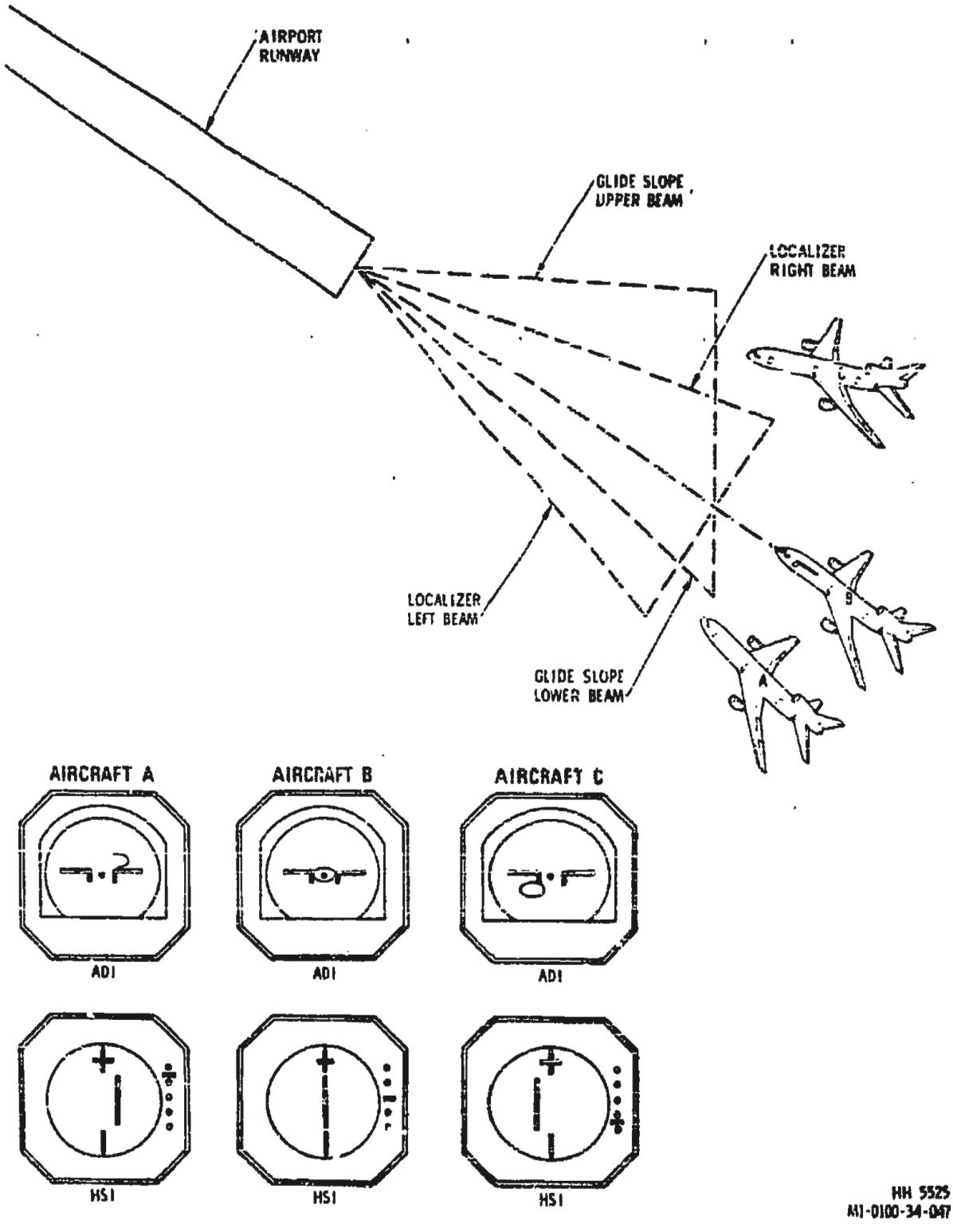
Localizer and Glideslope Channel Pairs (Frequencies in MHz)
Table 1

LOCALIZER FREQUENCY	CORRESPONDING GLIDESLOPE FREQUENCY	LOCALIZER FREQUENCY	CORRESPONDING GLIDESLOPE FREQUENCY
108.10	334.70	110.10	334.40
108.15	334.55	110.15	334.25
108.30	334.10	110.30	335.00
108.35	333.95	110.35	334.85
108.50	329.90	110.50	329.60
108.55	329.75	110.55	329.45
108.70	330.50	110.70	330.20
108.75	330.35	110.75	330.05
108.90	329.30	110.90	330.80
108.95	329.15	110.95	330.65
109.10	331.40	111.10	331.70
109.15	331.25	111.15	331.55
109.30	332.00	111.30	332.30
109.35	331.85	111.35	332.15
109.50	332.60	111.50	332.90
109.55	332.45	111.55	332.75
109.70	333.20	111.70	333.50
109.75	333.05	111.75	333.35
109.90	333.80	111.90	331.10
109.95	333.65	111.95	330.95

The radiation patterns (Ref. Fig. 2) for both localizer and glideslope functions are dual beams whose equal signal strength crossover points represent the desired aircraft position at any point along the approach path. The upper glideslope and left localizer beams are amplitude modulated at 90-Hz, and the lower glideslope and right localizer beams are modulated at 150-Hz. The intersection (equal signal strength crossover point) of the glide slope upper and lower beams represents a line extending upward from the runway along the approach path at an angle of 2.5 to 3-degrees, while the intersection of the localizer left and right beams represents an extension of the runway centerline.

R 2. Operation

The ILS (Ref. Fig. 3) receivers are dual-channel units with one channel for localizer and the other for glideslope. Other than the difference in frequency, both channels operate the same. The receiver input frequencies (channel pairs) are selected on the VHF NAV control panel as follows:



Localizer and Glide Slope Operation Pictorial Diagram
Figure 2

R Selecting any frequency with an odd one-tenth MHz digit (within the range of 108.10 to 111.95-MHz) on the VHF NAV control panel, causes both the localizer and glide slope receiver channels to select the proper crystals in the frequency synthesizer to tune the receiver to the desired frequency.

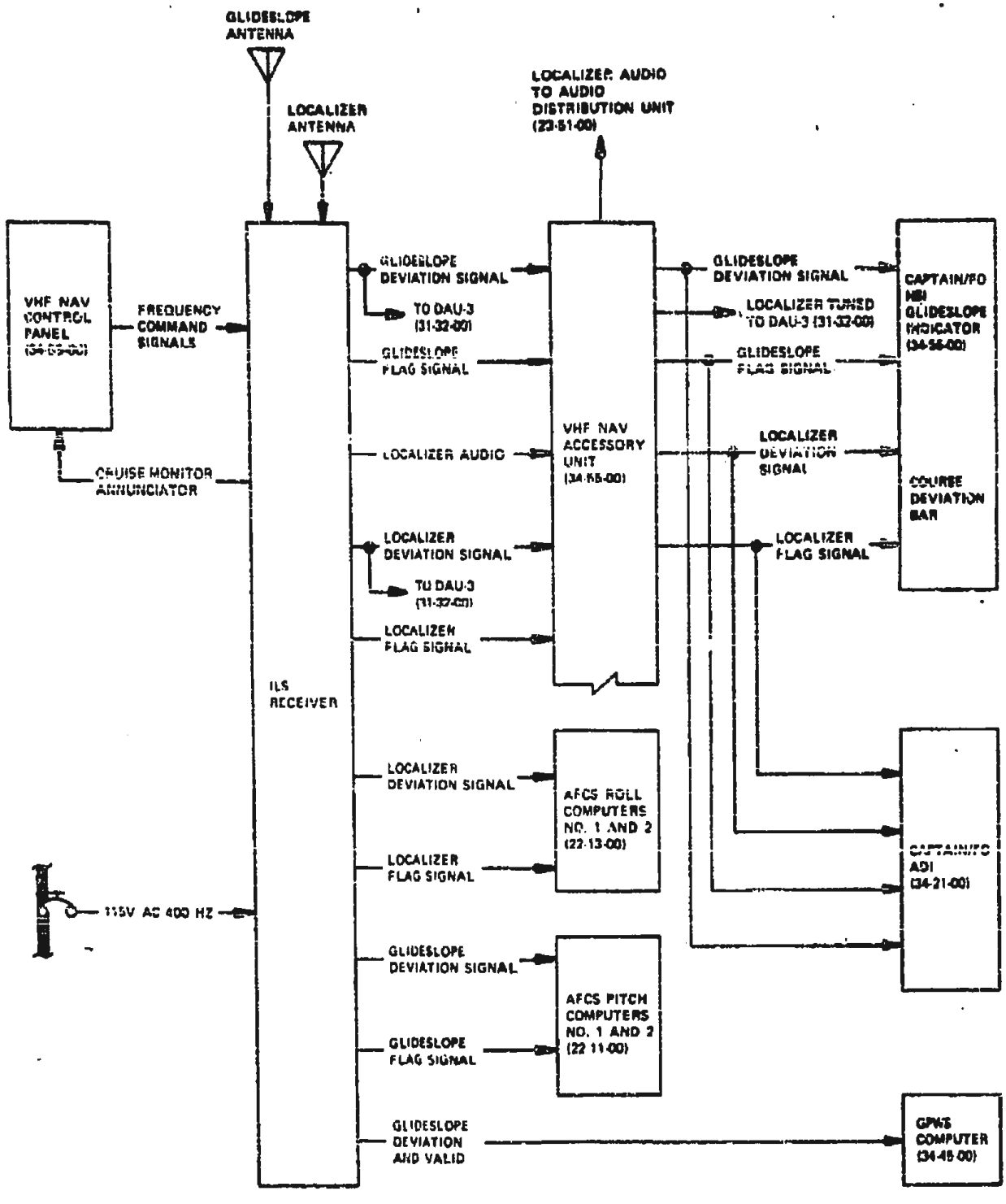
Selecting an odd one-tenth MHz frequency on the applicable VHF NAV control panel, removes the very high frequency omnidirectional ranging (VOR) command ground from the applicable VOR/ILS relays in the VHF NAV accessory unit. The relays deenergize to the ILS position, disconnecting the VOR outputs. The ILS receiver deviation outputs are now connected to their corresponding instrument displays.

If a frequency with an even one-tenth MHz digit is selected, the VOR command ground signal is applied to the applicable VOR/ILS relays in the VHF NAV accessory unit by the VHF NAV control panel. The relays energize to the VOR position, disconnecting the ILS outputs. The VOR outputs are connected to their corresponding instrument displays. The ILS receivers automatically switch to the cruise monitoring mode when VOR is selected.

The received localizer and glideslope RF signals are filtered, double-converted, amplified and detected, and the 90 and 150-Hz modulating signals are compared. The signal levels for the beam pairs are equal when the aircraft is on the desired flight path. Any deviation from the desired flight path will cause one modulation frequency signal level to predominate over the other; 90-Hz for up or left deviation and 150-Hz for down or right.

The deviation signals are provided as receiver outputs to the indicators and the autopilot. The localizer deviation signal (lateral) drives the HSI course deviation bar and the ADI localizer deviation pointer. The glideslope deviation signal drives the vertical glideslope indicator on the right side of the HSI and the ADI approach gate. A predominant 90-Hz deviation signal from the localizer or glideslope (representing left or up deviation from the desired flight path) will cause the HSI course deviation bar and ADI approach gate to move to the right, or the HSI glideslope indicator and ADI approach gate to move down. A predominant 150-Hz signal will have the opposite effect.

Since the center of the instrument scale represents aircraft position and the different displays represent the desired flight path, this then shows that the aircraft has moved to the left or above the desired flight path when the 90-Hz signal predominates. To bring the aircraft back on the correct flight path the pilot (or the AFCS) would then fly the aircraft, represented by the center of the display, toward the ILS



M1-000-34-048

R R Instrument Landing System Block Diagram
Figure 3

deviation indication. Thus when the aircraft is left of the localizer centerline the 90-Hz signal will predominate, the ILS deviation indicators will move to the right of center indicating that the aircraft is left of the desired flight path, and the pilot will steer the aircraft to the right to realign it with runway.

The ILS receiver functions are continuously monitored by functionally separate circuits which supply high-level (28V dc superflag) data valid signals to the AFCS, ADI, HSI, and GPWS (No. 2 ILS only). The following conditions will cause interruption of these data valid signals:

Deviation difference between two parallel internal receiver channels

Loss of 14.4-kHz multivibrator frequency standard for self test and monitoring

Variation in signal level by +50 or -30 percent due to receiver failures

No RF signal detected on selected channels

Loss of one signal (90 or 150-Hz) from the detected RF signal

Loss of 50% of the total 90/150-Hz modulation percentage

A drop in deflection sensitivity by 50% due to ground station failure

Improper number of grounds on the frequency control lines (ILS mode only - 2-out-of-5 frequency selection, disabled in VOR mode).

R Interruption of the 28V dc localizer and glideslope data valid signals will cause -the HSI-"TO-FROM" indicator to rotate to reveal a NAV flag, and the HSI GS flag to come into view. The ADI approach GATE flag in view indicates a fault in the ADI approach gate circuit. In the VOR mode, the HSI-NAV flag functions as a VOR failure warning, the ADI GS display is shuttered and the LOC flag is held out of view. When a VOR frequency is selected, the ILS receiver automatically switches to the cruise monitoring mode. The ILS receiver is continuously exercised by the receiver self-test circuits which alternately apply up/left and down/right deviation signals to both receiver channels every 3.2-seconds. These deviation signals will not be displayed, as the HSI is disconnected from the ILS receiver in the VOR mode and the ADI - ILS displays are not in view.

The conditions required for the approach gate to come into view are as follows:

Localizer valid

Flare enable or glideslope enable

Glideslope valid

No rollout enable signal present

NOTE: During the approach land mode (Ref. 22-00-00), when the aircraft descends through 50-feet radio altitude (Ref. 34-32-00), the approach gate centers vertically. At five feet, the approach gate is biased out of view and the rollout pointer comes into view.

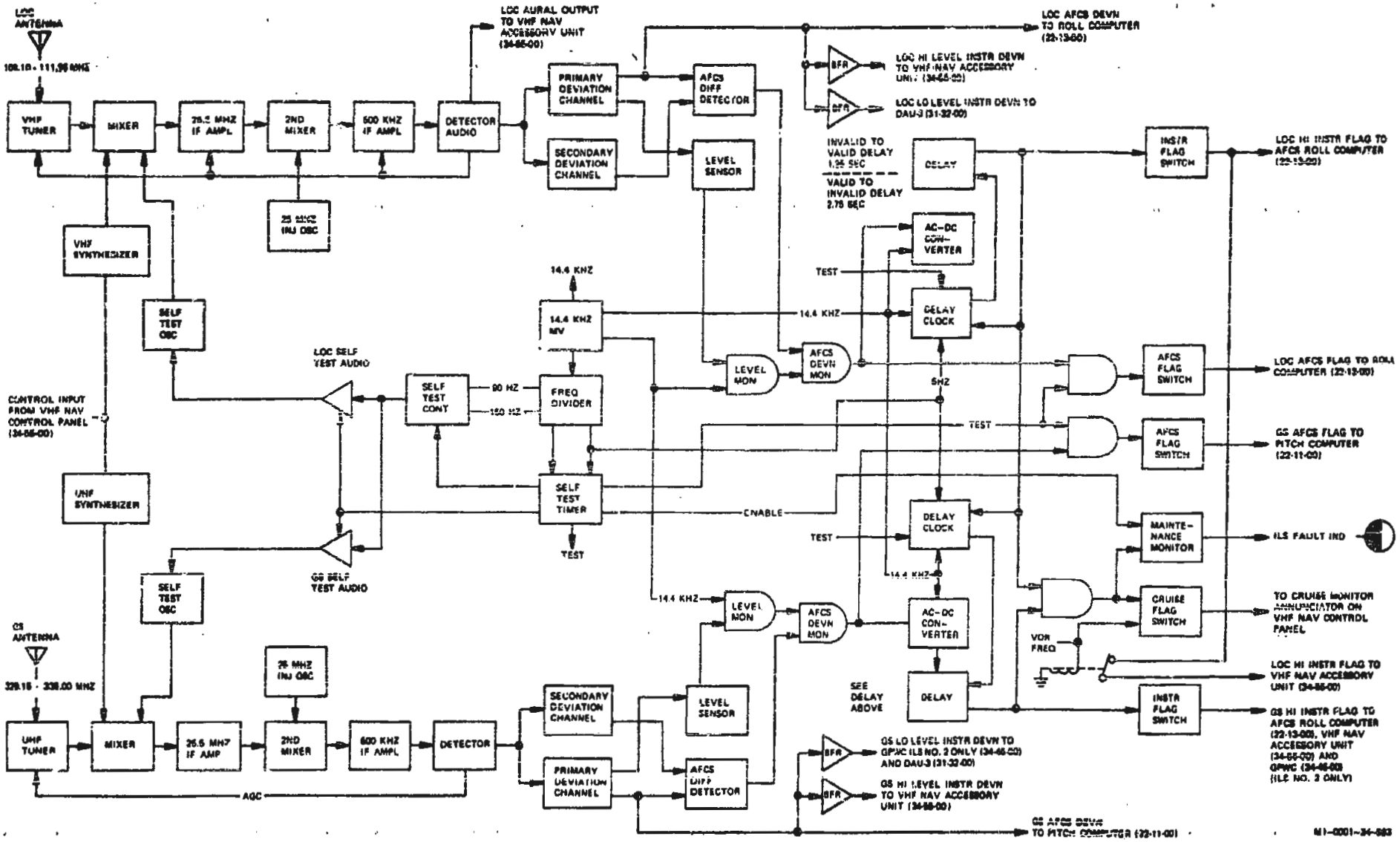
3. Receiver (ILS)

The ILS receiver converts localizer and glideslope signals into vertical and horizontal guidance information for instrument landings, and provides an aural ground station identification output. The receiver is housed in an ARINC 3/8 ATR short case mounted on the rear rack in the forward electronics service center, zone 113. The front panel contains a single FAULT indicator. The rear panel contains a dual-electrical connector for system interface, and a single electrical connector for test purposes.

Fixed tuned filters and a crystal filter provide the selectivity for the receivers. Crystal matrix synthesizers provide the injection frequencies. Instrumentation circuits are provided with dual channels that are monitored for comparison accuracy. The monitor, with fail-safe circuits, inhibits the superflag (+28V dc) output for all failure conditions. Cruise monitoring permits detection of in-flight system failures. The self-latching FAULT indicator on the front panel provides an indication of receiver failure.

A. General

R The ILS receiver (Ref. Fig. 4) provides reception on 40 localizer channels from 108.10 to 111.95-MHz, and 40 paired glideslope channels from 329.15 to 335.00-MHz (Ref. Table 1). The receiver processes localizer and glideslope signals and provides output data to the ADI (Ref. 34-21-00), the HSI (Ref. 34-55-00), the Flight Recorder (Ref. 31-31-00) the AFCS (Ref. 22-00-00), and glideslope deviation only from ILS No. 2 to the ground proximity warning system (Ref. 34-45-00).


LOC ANTENNA
108.10 - 111.95 MHZ
VHF TUNER
MIXER
25.5 MHZ IF AMPL
2ND MIXER
500 KHZ IF AMPL
DETECTOR AUDIO
LOC AURAL OUTPUT TO VHF NAV ACCESSORY UNIT (34-55-00)
PRIMARY DEVIATION CHANNEL
SECONDARY DEVIATION CHANNEL
AFCS DIFF DETECTOR
LEVEL SENSOR
BFR
LOC AFCS DEVN TO ROLL COMPUTER (22-13-00)
LOC HI LEVEL INSTR DEVN TO VHF NAV ACCESSORY UNIT (34-55-00)
LOC LO LEVEL INSTR DEVN TO DAU-3 (31-32-00)
INVALID TO VALID DELAY 1.35 SEC
VALID TO INVALID DELAY 2.75 SEC
DELAY
INSTR FLAG SWITCH
LOC HI INSTR FLAG TO AFCS ROLL COMPUTER (22-13-00)
25 MHZ INJ OSC
VHF SYNTHESIZER
AC-DC CONVERTER
TEST
14.4 KHZ
DELAY CLOCK
SELF TEST OSC
14.4 KHZ MV
LOC SELF TEST AUDIO
LEVEL MON
AFCS DEVN MON
AFCS FLAG SWITCH
LOC AFCS FLAG TO ROLL COMPUTER (22-13-00)
CONTROL INPUT FROM VHF NAV CONTROL PANEL (34-55-00)
SELF TEST CONT
90 HZ
150 HZ
FREQ DIVIDER
5HZ
GS AFCS FLAG TO PITCH COMPUTER (22-11-00)
SELF TEST TIMER
ENABLE
MAINTE-NANCE MONITOR
ILS FAULT IND
GS SELF TEST AUDIO
CRUISE FLAG SWITCH
TO CRUISE MONITOR ANNUNCIATOR ON VHF NAV CONTROL PANEL
VOR FREQ
LOC HI INSTR FLAG TO VHF NAV ACCESSORY UNIT (34-55-00)
SEE DELAY ABOVE
GS HI INSTR FLAG TO AFCS ROLL COMPUTER (22-13-00), VHF NAV ACCESSORY UNIT (34-55-00) AND GPWC (34-45-00) (ILS NO. 2 ONLY)
GS ANTENNA
329.15 - 335.00 MHZ
UHF TUNER
MIXER
25.5 MHZ IF AMP
2ND MIXER
600 KHZ IF AMPL
DETECTOR
AGC
GS LO LEVEL INSTR DEVN TO GPWC ILS NO. 2 ONLY (34-45-00) AND DAU-3 (31-32-00)
GS HI LEVEL INSTR DEVN TO VHF NAV ACCESSORY UNIT (34-55-00)
GS AFCS DEVN TO PITCH COMPUTER (22-11-00)
MI-0001-34-003

R
R ILS Receiver Block Diagram
Figure 4

EFFECTIVITY: ALL

001B

Localizer and glideslope functions are similar in operation; the main difference is that the localizer is a VHF receiver, and the glideslope is a UHF receiver. Operating frequencies and VOR/ILS mode selection are selected on the VHF NAV control panel (Ref. 34-55-00). Receiver inputs from the antennas are applied to preselection filters in the RF assemblies. Automatic gain control PIN diodes are used as RF attenuators to protect the balanced mixers from overload by strong signals. Balanced FET mixers heterodyne the input signals with the synthesizer injection signals to produce the 25.5-MHz IF output.

B. 25.5-MHz Crystal Filters

The 25.5-MHz IF crystal filters provide the receiver selectivity. The 25.0-MHz oscillator provides the injection signal to the second mixer to convert the first IF frequency to 500-kHz. The second IF amplifier provides the gain necessary for proper detector output. The detectors provide an AGC output signal for constant gain control, and a localizer aural output signal for ground station identification. The detected 90 and 150-Hz localizer and glide slope signals are applied to dual-deviation instrumentation channels. The outputs provide guidance information to the various interfacing systems.

C. Test and Monitor Functions

A 14.4-kHz multivibrator is the frequency standard for the test and monitor functions of the receiver. The 14.4-kHz signal is ANDed with the level detector outputs that are a function of the signals being within a specified range. These outputs are ANDed with the difference-in-deviation outputs to provide ac logic validity signals for the localizer and glideslope flags. The ac validity (data valid, +28 dc superflag) signals keep the localizer and glideslope autoflight control system and instrument flags in an out-of-view condition. An error sensed by the monitor circuits causes the superflag signal to be inhibited, allowing the applicable flag to come into view.

In the cruise mode (VOR mode), the self-test generator applies continuous signals to the localizer and glideslope receivers. A timing circuit in the generator keys an up/left deviation for 3.2-seconds, then a down/right deviation for 3.2-seconds. This provides a continuous test signal to the receiver functions and to the auto flight control system.

A CRUISE MONITOR annunciator located on each VHF NAV control panel is controlled by the localizer and glideslope flag signals within the applicable ILS

receiver when the VHF NAV system is in the VOR (cruise) mode. If the receiver self-test (cruise mode) fails, the CRUISE MONITOR annunciator on the applicable VHF NAV control panel comes on warning the flight crew of an ILS failure prior to actual ILS selection.

4. Dual Glideslope Antenna

The glideslope antenna is a horizontally polarized half-wave folded dipole with a hybrid multiplexing device which is terminated in two parallel BNC-type connectors. The antenna is connected to parallel 50-ohm loads, and exhibits VSWR characteristics of 2 to 1 or less over the glideslope frequency range of 329.15 to 335.00-MHz. Disconnecting either load results in a loss of less than 3 db to the other output at any frequency within the glideslope range. Since the weather radar antenna is located directly above the glideslope antenna, zone 111, a reflecting device is placed between the two antennas. The device is a parasitic reflective element approximately one-quarter wavelength long at the center of the glideslope frequency band, and is located approximately 5 inches above the glideslope antenna. The device is horizontally polarized and isolated from both the antenna and aircraft structure.

The antenna is approximately 7 inches long, 5 inches wide, 2 inches thick, and is provided with a protective fiberglass cover.

5. Dual Localizer Antenna

The localizer antenna is a horizontally polarized half-wave folded dipole with a hybrid multiplexing device which is terminated in two parallel BNC type connectors. The antenna is connected to parallel 50-ohm loads, and exhibits voltage standing wave ratio (VSWR) characteristics of 2 to 1 or less over the localizer frequency range of 108.10 to 111.95-MHz. Disconnecting either load results in a loss of less than 3-db to the other output at any frequency within the localizer range.

The antenna is approximately 16-inches long and 14-inches wide. The antenna is located on the nose radome bulkhead above the weather radar antenna in zone 111.

INSTRUMENT LANDING SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If flight crew reports a trouble using a fault code, the code can be found in 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for a more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

C NOTE: If a logbook write up states that a VOR/ILS system is
C inoperative on some frequencies or specifies those
C frequencies, confirmation that corrective action has been
C effective must be made by:

C (1) Using an R&R 90150 or equivalent ramp tester - check
C that all combinations of VOR/ILS frequencies are
C operative, or

C (2) Using an R&R 90150 or equivalent ramp tester - check
C that the frequencies noted in the logbook are
C operative.

CR NOTE: If an R&R 90150 ramp tester or equivalent is not
CR available and a flight delay or cancellation would result
CR from obtaining a tester, ramp testers R&R 90166, 90179,
CR or 90180 may be used, a log book note made that the

CR system was checked only on the single frequency and the
CR MCIMD Maintenance Coordinator notified to have the system
CR tested with an R&R 90150 tester at the first station so
CR equipped.

2. Supplemental Fault Isolation Data

A. Fault Isolation Using FIM

(1) Introduction

The Instrument Landing System (ILS), is equipped with a Fault Isolation Monitoring (FIM) system which identifies faults within the ILS to Line Replaceable Unit (LRU). Instructions provided by Fault Isolation diagrams, enable avionics technicians to quickly diagnose and accurately correct an ILS fault. This is accomplished utilizing the FIM indicator located on front panel of each ILS unit in conjunction with any information provided by the flight squawk.

FIM is continuously monitoring ILS while in-flight under actual environmental and operational conditions, but only in CRUISE mode (ILS frequency not tuned). This enables FIM to detect and indicate static faults and dynamic faults which cannot be duplicated by maintenance personnel on ground. FIM minimizes need for on-board test equipment and bulky/lengthy troubleshooting procedures in maintenance manual.

(2) Description

There is one FIM ball located on front of the ILS receiver which is operational only in CRUISE mode (ILS frequency not tuned). Because instrument flags (LOC and GS) are purposely biased out of view during this mode, it acts as an alternate to the flag.

The CRUISE lamp on VHF NAV control panel operates in parallel with ILS receiver FIM ball.

During cruise mode an internally generated Self Test signal continually exercises the ILS receiver by alternately applying up/left and down/right deviation signals to both receiver channels (LOC - GS) every 3.2-seconds. Any malfunction will set ILS receiver FIM ball.

Front end circuits, injection amplifiers, synthesizer and power supply are not monitored by FIM, but activate

instrument flag circuits should failure occur when not in cruise.

3. Equipment and Materials

Test Set, TIC-30A, or equivalent

4. Fault Isolation Indentification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide component locations for Instrument Landing System (ILS) and associated components.

Fault Isolation Diagrams and Schematics List
Table 101

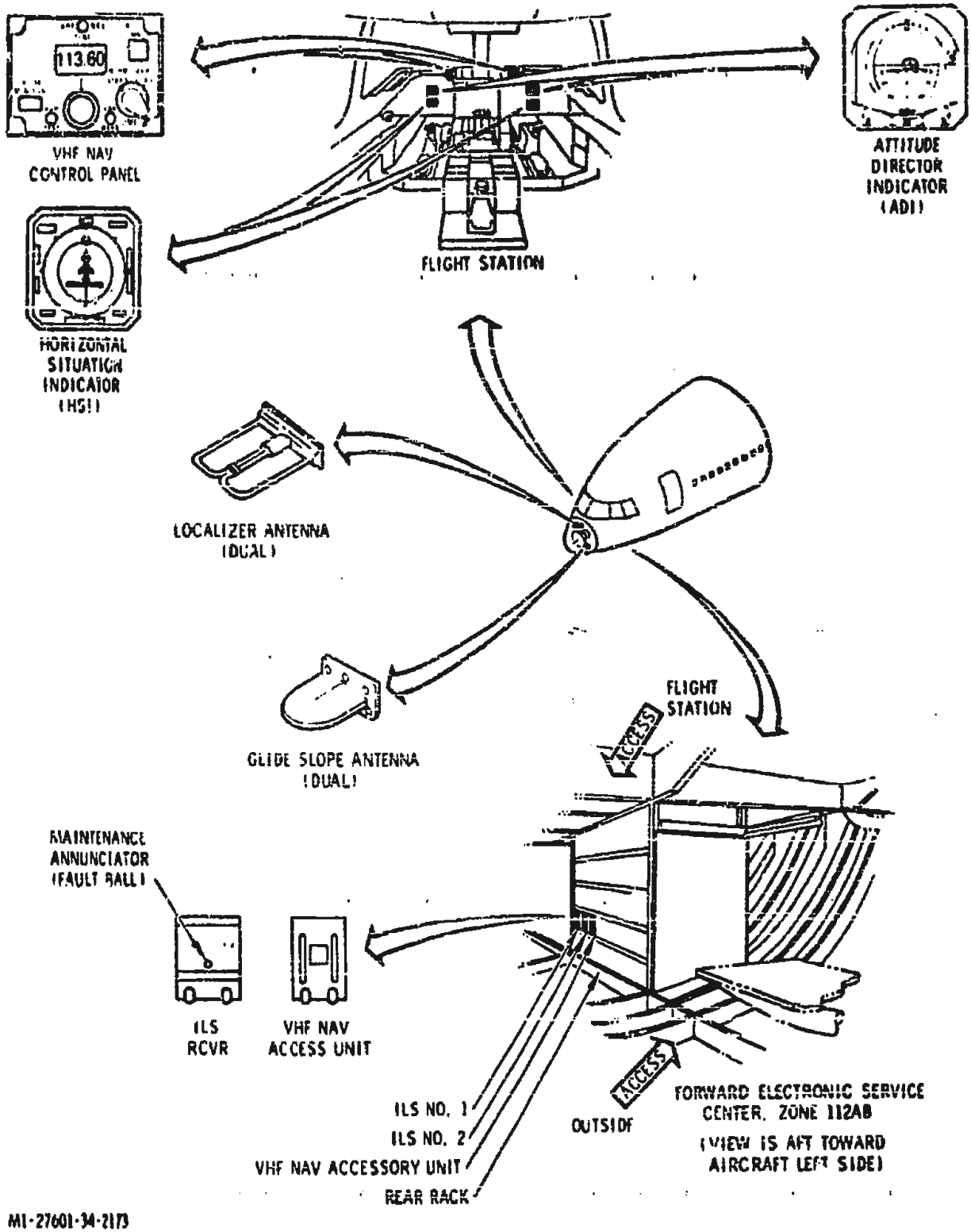
	FIGURE NUMBER	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	ILS-ADI Displayed Problems
	104	ILS-HSI Displayed Problems
	105	Audio or Frequency Select Problem
	106	FIM Ball Check Procedure
R	SCHEM 1	ILS Schematic (ILS-1 on 025, 026, 028-031) and
R	(Sheet 1)	(ILS-2 on 001-024, 027)
	SCHEM 1 (Sheet 2)	ILS Schematic (ILS-1)
	SCHEM 1 (Sheet 3)	ILS Schematic (VHF NAV Access Unit)
	SCHEM 1 (Sheet 4)	ILS Schematic (HSI)
	SCHEM 1 (Sheet 5)	ILS Schematic (ADI)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA – GLIDESLOPE (DUAL)	1	RADOME	34–33–04
ANTENNA – LOCALIZER (DUAL)	1	RADOME	34–33–08
INDICATOR – ATTITUDE DIRECTOR	2	FLT STA, CAPT AND F/O INSTR PNL	34–21–07
INDICATOR – HORIZONTAL SITUATION	2	FLT STA, CAPT AND F/O INSTR PNL	34–55–04
PANEL – VHF NAV CONTROL	2	FLT STA, GLRSHLD PNL	34–55–02
RECEIVER – ILS	2	FESC, REAR RACK/112AB	34–33–01
UNIT – VHF NAV ACCESSORY	1	FESC, REAR RACK/112AB	34–55–08

M1-0000-34-3353

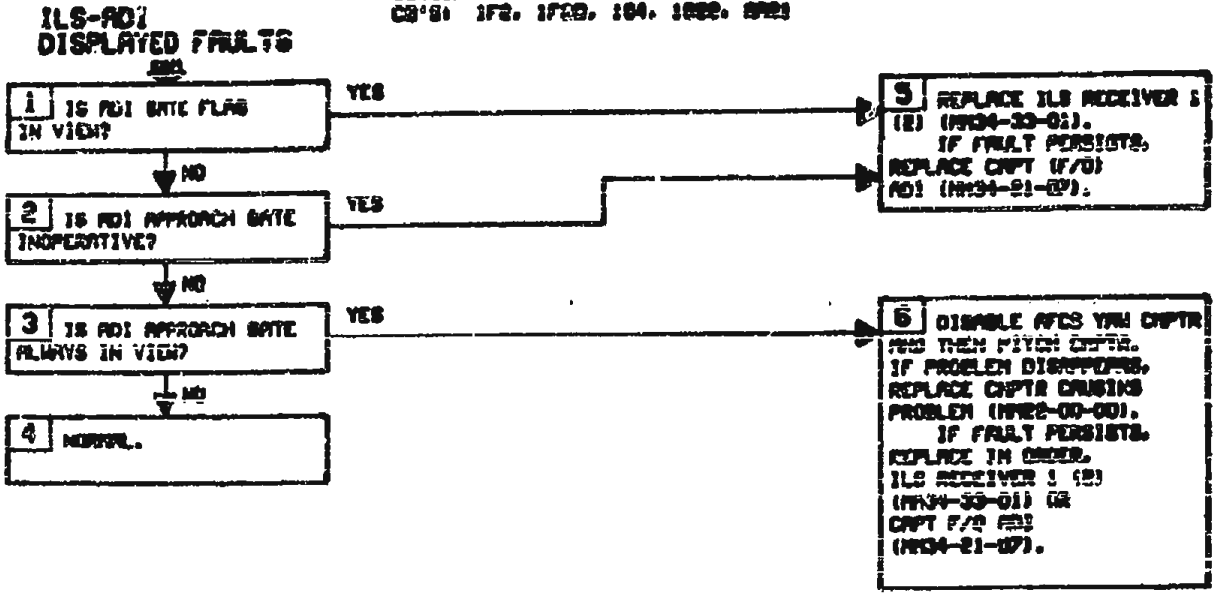
Component Location Index
Figure 101

R
R
001B EFFECTIVITY: ALL



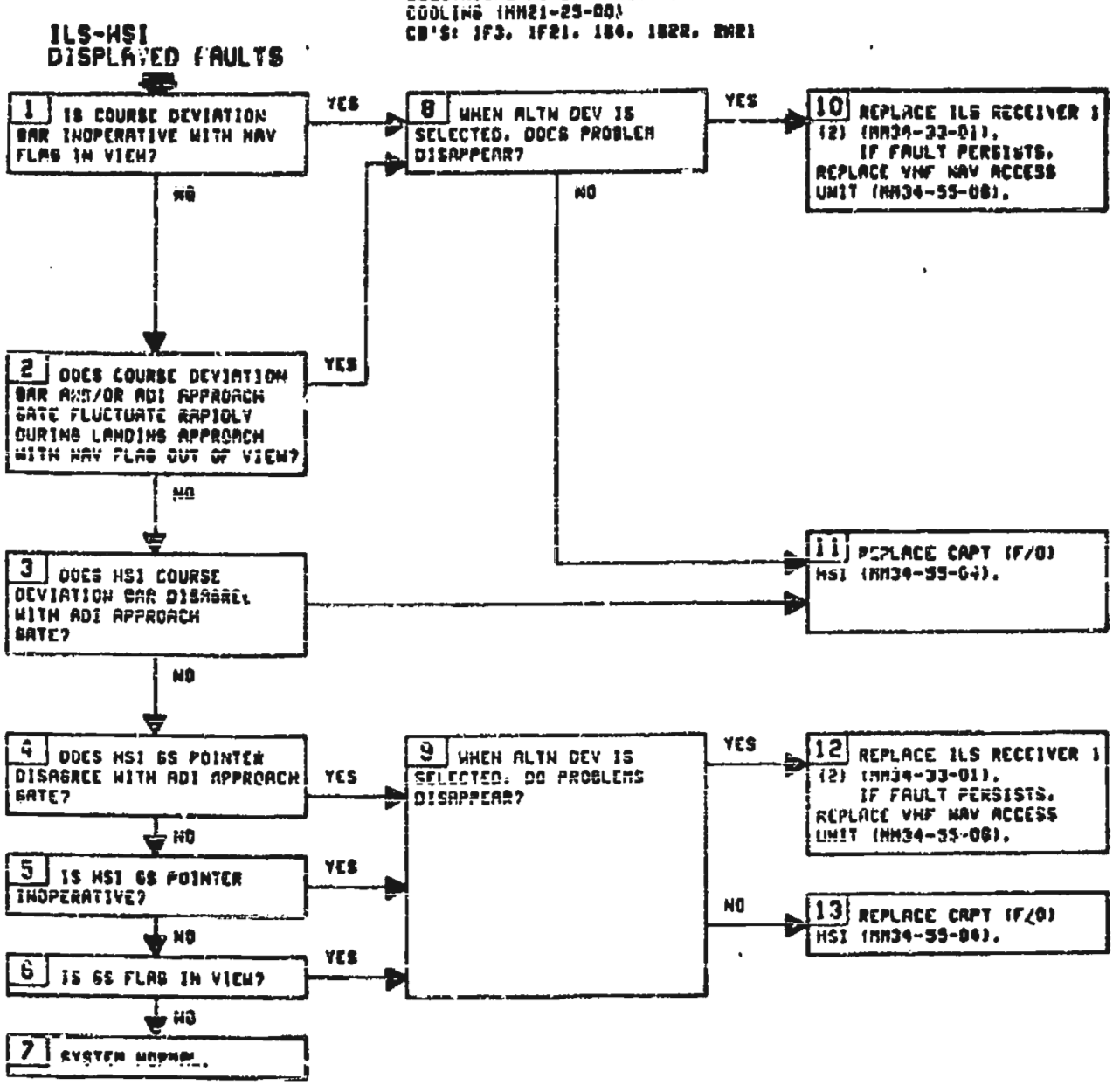
Component Locator Diagram
Figure 102

PREREQUISITES
ELECTRICAL POWER (
COOLING (
CB'S: 1F2, 1F20, 1B4, 1B82, 8P21



ILS-ADI Displayed Faults
Figure 103

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S: 1F3, 1F21, 184, 182B, 2M21

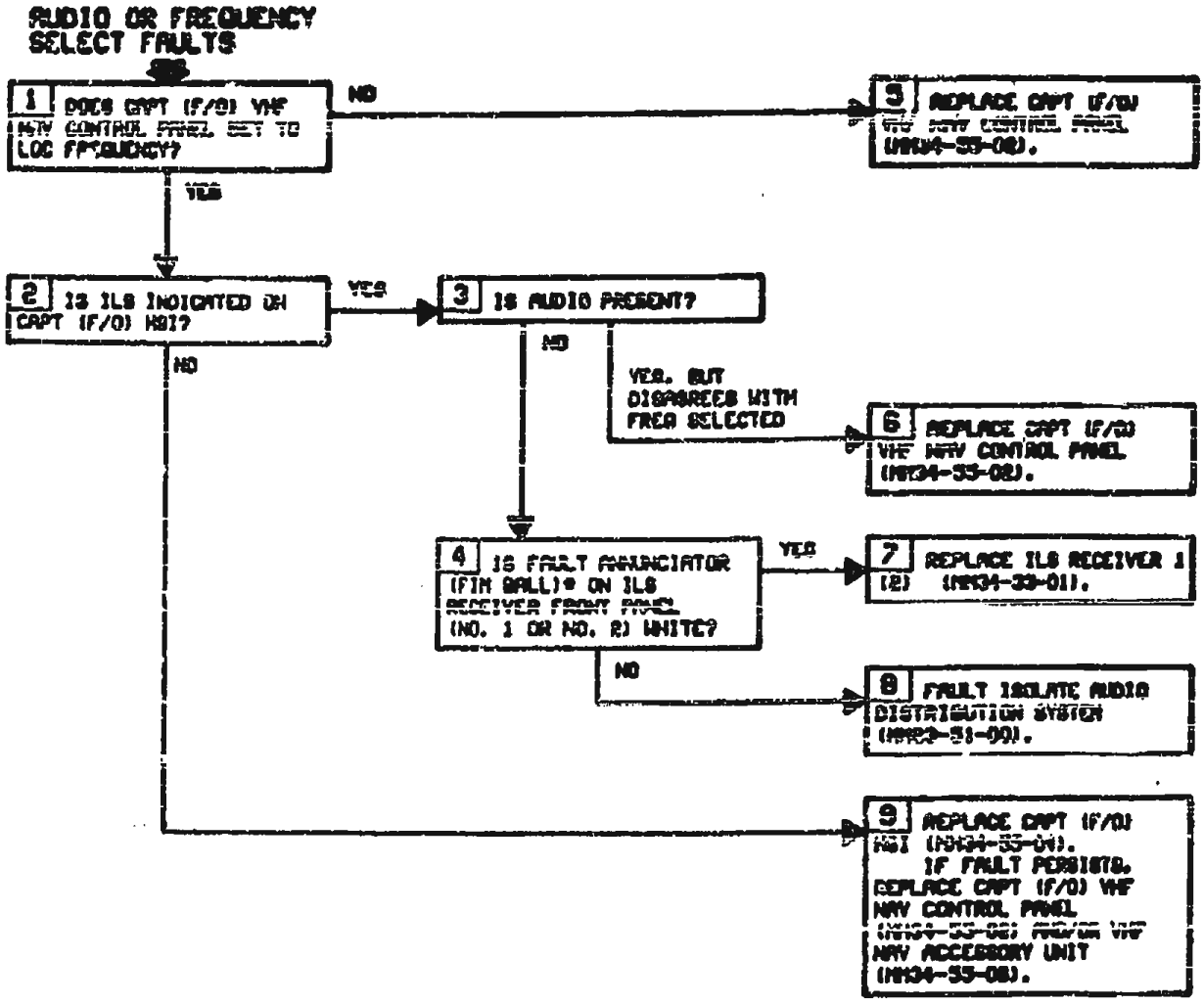

ILS-HSI
DISPLAYED FAULTS
1 IS COURSE DEVIATION BAR INOPERATIVE WITH NAV FLAG IN VIEW?
YES
NO
8 WHEN ALTN DEV IS SELECTED, DOES PROBLEM DISAPPEAR?
YES
NO
10 REPLACE ILS RECEIVER 1 (2) (MM34-33-01). IF FAULT PERSISTS, REPLACE VHF NAV ACCESS UNIT (MM34-55-06).
2 DOES COURSE DEVIATION BAR AND/OR ADI APPROACH GATE FLUCTUATE RAPIDLY DURING LANDING APPROACH WITH NAV FLAG OUT OF VIEW?
YES
NO
3 DOES HSI COURSE DEVIATION BAR DISAGREE WITH ADI APPROACH GATE?
NO
11 REPLACE CAPT (F/O) HSI (MM34-55-04).
4 DOES HSI GS POINTER DISAGREE WITH ADI APPROACH GATE?
YES
NO
9 WHEN ALTN DEV IS SELECTED, DO PROBLEMS DISAPPEAR?
YES
NO
12 REPLACE ILS RECEIVER 1 (2) (MM34-33-01). IF FAULT PERSISTS, REPLACE VHF NAV ACCESS UNIT (MM34-55-06).
13 REPLACE CAPT (F/O) HSI (MM34-55-04).
5 IS HSI GS POINTER INOPERATIVE?
YES
NO
6 IS GS FLAG IN VIEW?
YES
NO
7 SYSTEM NORMAL.

NOTE
SEE FIN BALL CHECK, FIGURE 106

AI-0001-34-3337

ILS-HSI Displayed Faults
Figure 104

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S IF3, JF21, 184, 18EE, 8M1
SET AUDIO SELECTOR PANELS FOR ILS AUDIO.
SET SPEAKER VOLUME
VHF NAV CONTROL PANEL OF SYSTEM UNDER TEST SET TO LOCAL ILS FREQUENCY

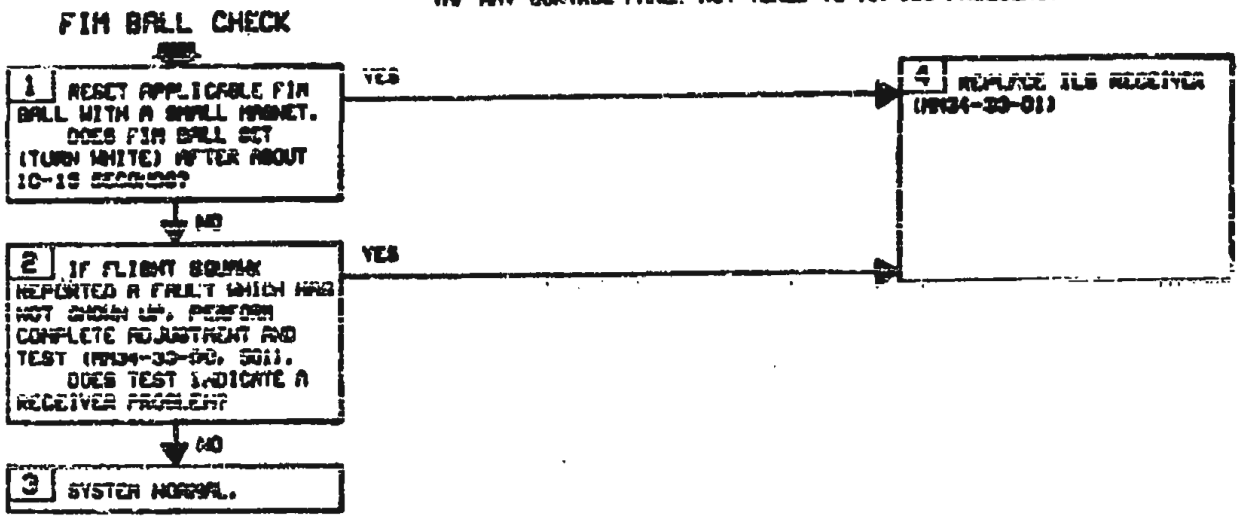

AUDIO OR FREQUENCY SELECT FAULTS
1 DOES CAPT (F/O) VHF NAV CONTROL PANEL SET TO LOC FREQUENCY?
NO
3 REPLACE CAPT (F/O) VHF NAV CONTROL PANEL (MM34-33-08).
YES
2 IS ILS INDICATED ON CAPT (F/O) HSI?
YES
3 IS AUDIO PRESENT?
NO
YES, BUT DISAGREES WITH FREQ SELECTED
6 REPLACE CAPT (F/O) VHF NAV CONTROL PANEL (MM34-33-08).
4 IS FAULT ANNUNCIATOR (FIN BALL)* ON ILS RECEIVER FRONT PANEL (NO. 1 OR NO. 2) WHITE?
YES
7 REPLACE ILS RECEIVER 1 (2) (MM34-33-01).
NO
8 FAULT ISOLATE AUDIO DISTRIBUTION SYSTEM (MM23-51-00).
NO
9 REPLACE CAPT (F/O) HSI (MM34-33-04).
IF FAULT PERSISTS, REPLACE CAPT (F/O) VHF NAV CONTROL PANEL (MM34-33-08) AND/OR VHF NAV ACCESSORY UNIT (MM34-33-08).

NOTE
* SEE FIN BALL CHECK DISPLAY, FIGURE 106

M-0001-34-1188

Audio or Frequency Select Faults
Figure 105

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB'S: 184, 1822
VHF NAV CONTROL PANEL NOT TUNED TO AN ILS FREQUENCY

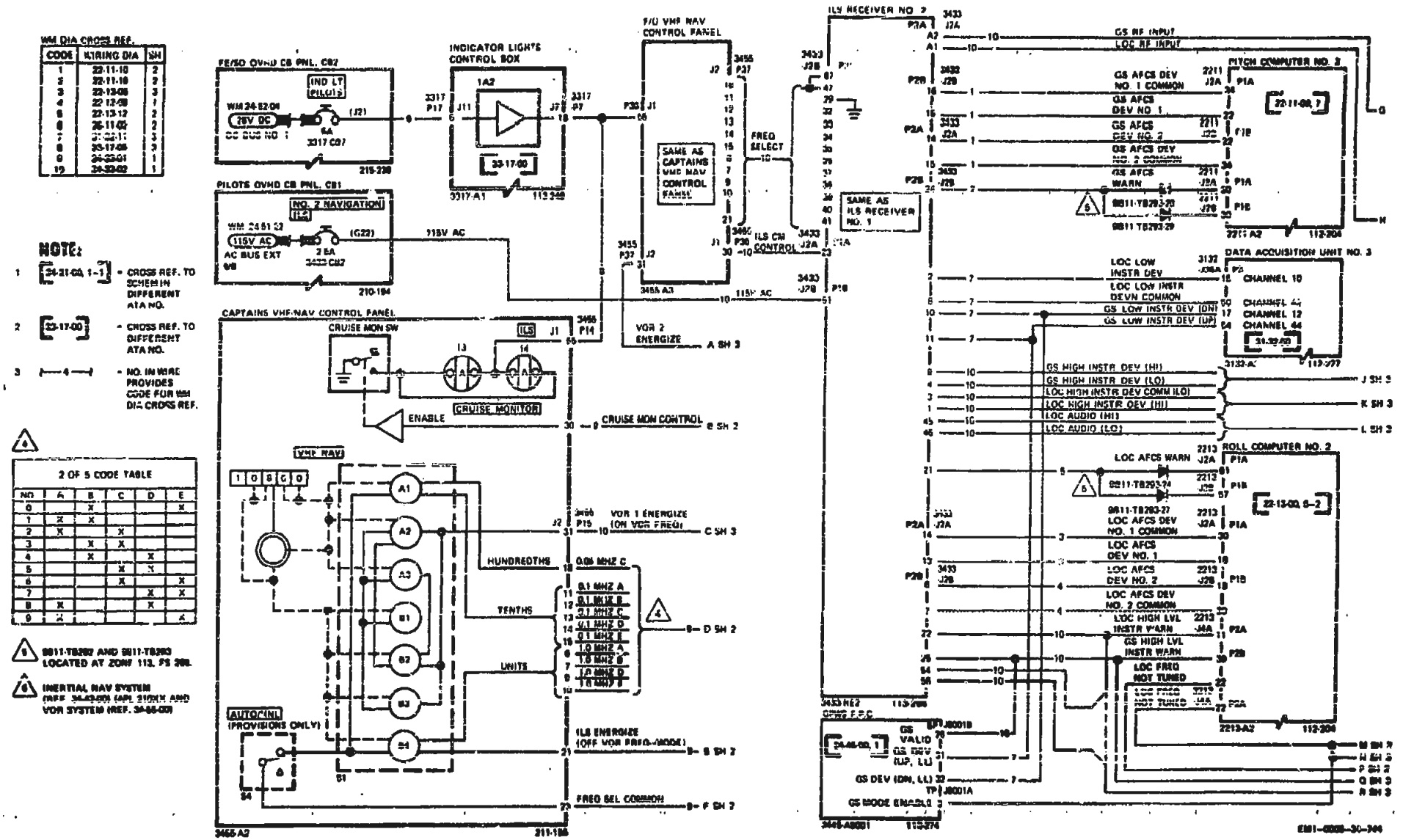

FIM BALL CHECK
1 RESET APPLICABLE FIM BALL WITH A SMALL MAGNET. DOES FIM BALL SET (TURN WHITE) AFTER ABOUT 10-15 SECONDS?
YES
4 REPLACE ILS RECEIVER (MM34-33-01)
NO
2 IF FLIGHT SQUAWK REPORTED A FAULT WHICH HAS NOT SHOWN UP, PERFORM COMPLETE ADJUSTMENT AND TEST (MM34-33-00, 501). DOES TEST INDICATE A RECEIVER PROBLEM?
YES
NO
3 SYSTEM NORMAL.

NOTE

FIM = FAULT ISOLATION MONITOR
FIM IS BLACK WITH NO FAULT, WHITE WITH FAULT

M1-C001-34-XXX

FIM Ball Check Procedure
Figure 106

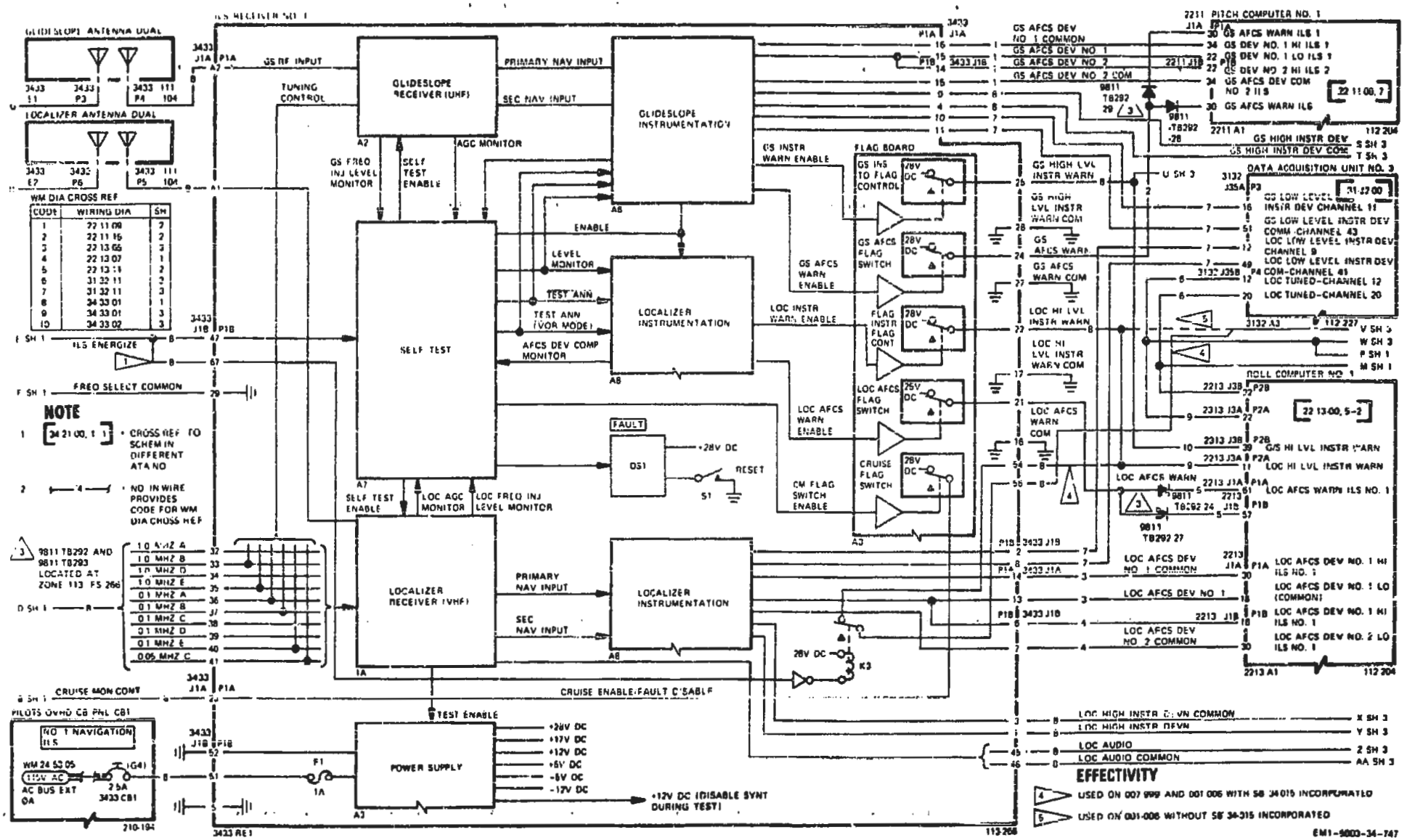


Instrument Landing System (ILS-2) Schematic
SCHEM 1 (Sheet 1)

CR
CR

EFFECTIVITY: 001-024, 027

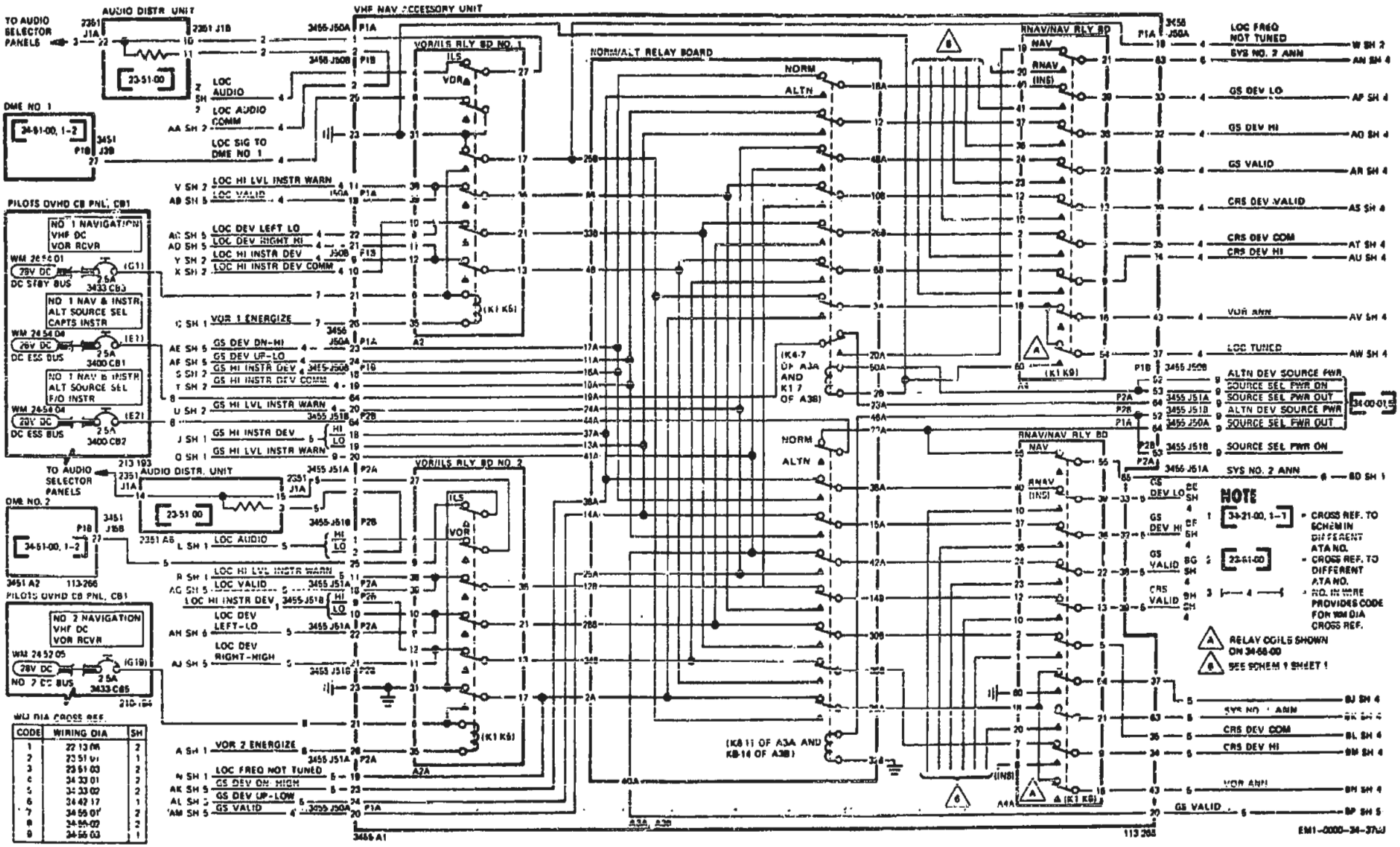
001B


GLIDESLOPE ANTENNA DUAL
LOCALIZER ANTENNA DUAL
GLIDESLOPE RECEIVER (UHF)
GLIDESLOPE INSTRUMENTATION
LOCALIZER INSTRUMENTATION
SELF TEST
LOCALIZER RECEIVER (VHF)
POWER SUPPLY
FLAG BOARD
GS AFCS FLAG SWITCH
LOC AFCS FLAG SWITCH
CRUISE FLAG SWITCH
PRIMARY NAV INPUT
SEC NAV INPUT
TUNING CONTROL
GS RF INPUT
GS FREQ INJ LEVEL MONITOR
SELF TEST ENABLE
AGC MONITOR
LOC AGC MONITOR
LOC FREQ INJ LEVEL MONITOR
GS INSTR WARN ENABLE
LOC INSTR WARN ENABLE
GS AFCS WARN ENABLE
LOC AFCS WARN ENABLE
CM FLAG SWITCH ENABLE
TEST ANN (VOR MODE)
AFCS DEV COMP MONITOR
FREQ SELECT COMMON
ILS ENERGIZE
CRUISE ENABLE-FAULT DISABLE
TEST ENABLE
+28V DC
+12V DC (DISABLE SYNT DURING TEST)
PITCH COMPUTER NO. 1
ROLL COMPUTER NO. 1
DATA ACQUISITION UNIT NO. 3
GS HIGH INSTR DEV
GS HIGH INSTR DEV COM
GS HIGH LVL INSTR WARN
GS AFCS WARN
GS AFCS WARN COM
LOC HI LVL INSTR WARN
LOC HI LVL INSTR WARN COM
LOC AFCS WARN
LOC AFCS WARN COM
GS AFCS DEV NO 1 COMMON
GS AFCS DEV NO 1
GS AFCS DEV NO 2
GS AFCS DEV NO 2 COM
LOC AFCS DEV NO 1 COMMON
LOC AFCS DEV NO 1
LOC AFCS DEV NO 2 COMMON
LOC AUDIO
LOC AUDIO COMMON
WM DIA CROSS REF
NOTE
NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
9811 TB292 AND 9811 TB293 LOCATED AT ZONE 113 FS 266
PILOTS OVHD CB PNL CB1
AC BUS EXT
EFFECTIVITY
USED ON 001 999 AND 001 006 WITH SB 34-315 INCORPORATED
USED ON 001-006 WITHOUT SB 34-315 INCORPORATED

CR Instrument Landing System (ILS-1) Schematic
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: 001-024, 027

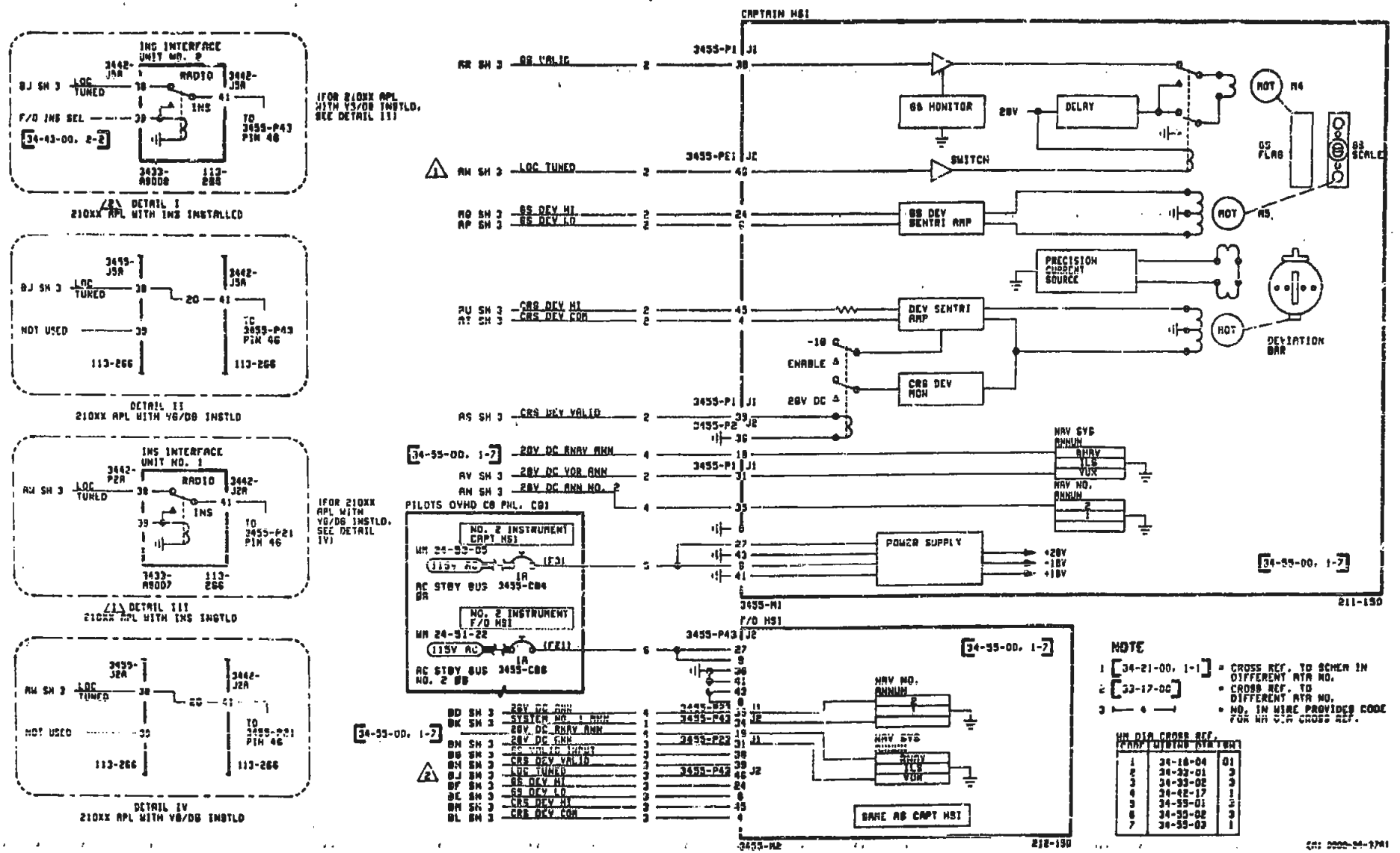
0018



CR Instrument Landing System (VHF NAV Access Unit) Schematic
CR SCHEM 1 (Sheet 3)

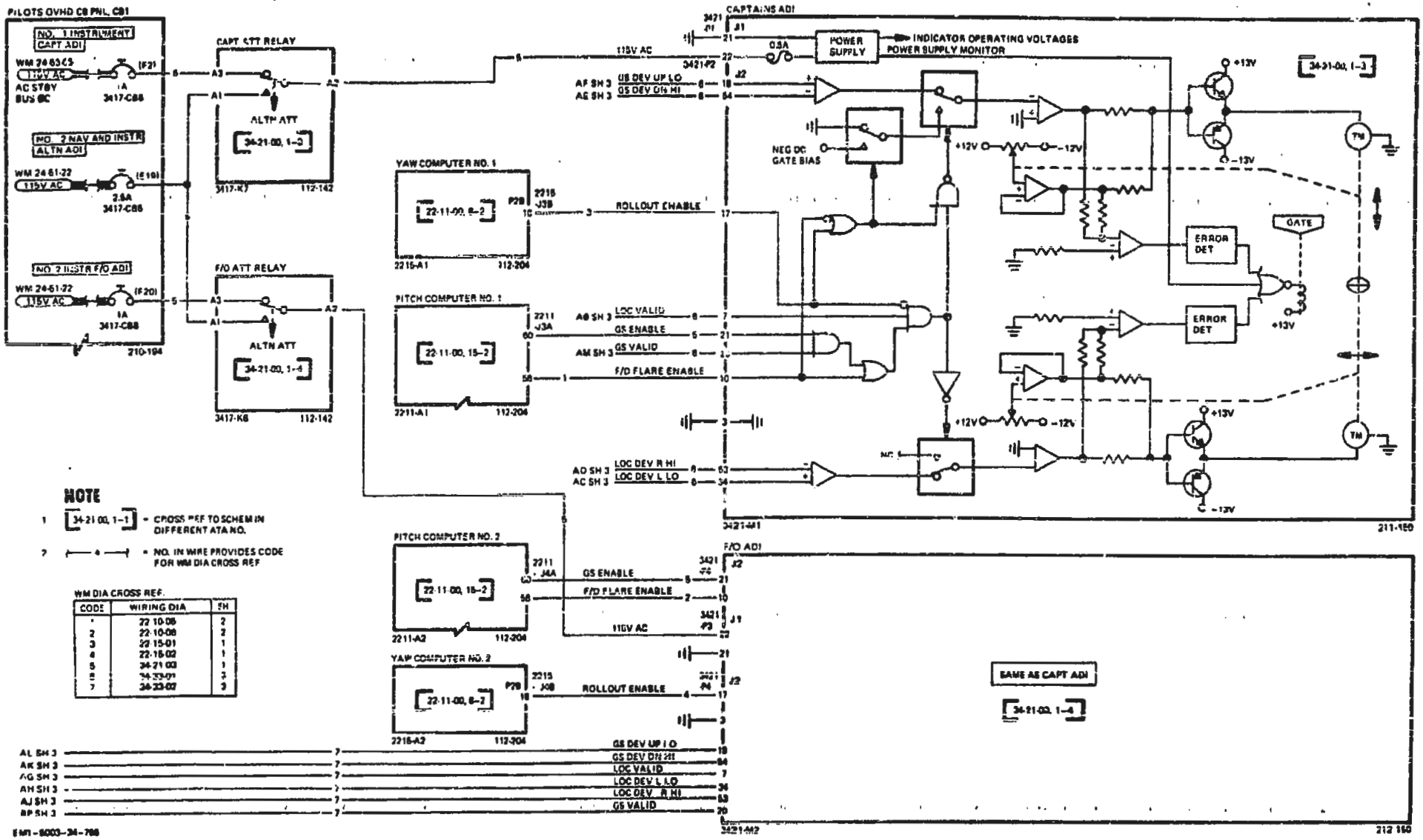
EFFECTIVITY: 001-024, 027

001B



CR Instrument Landing System (HSI) Schematic
CR SCHEM 1 (Sheet 4)

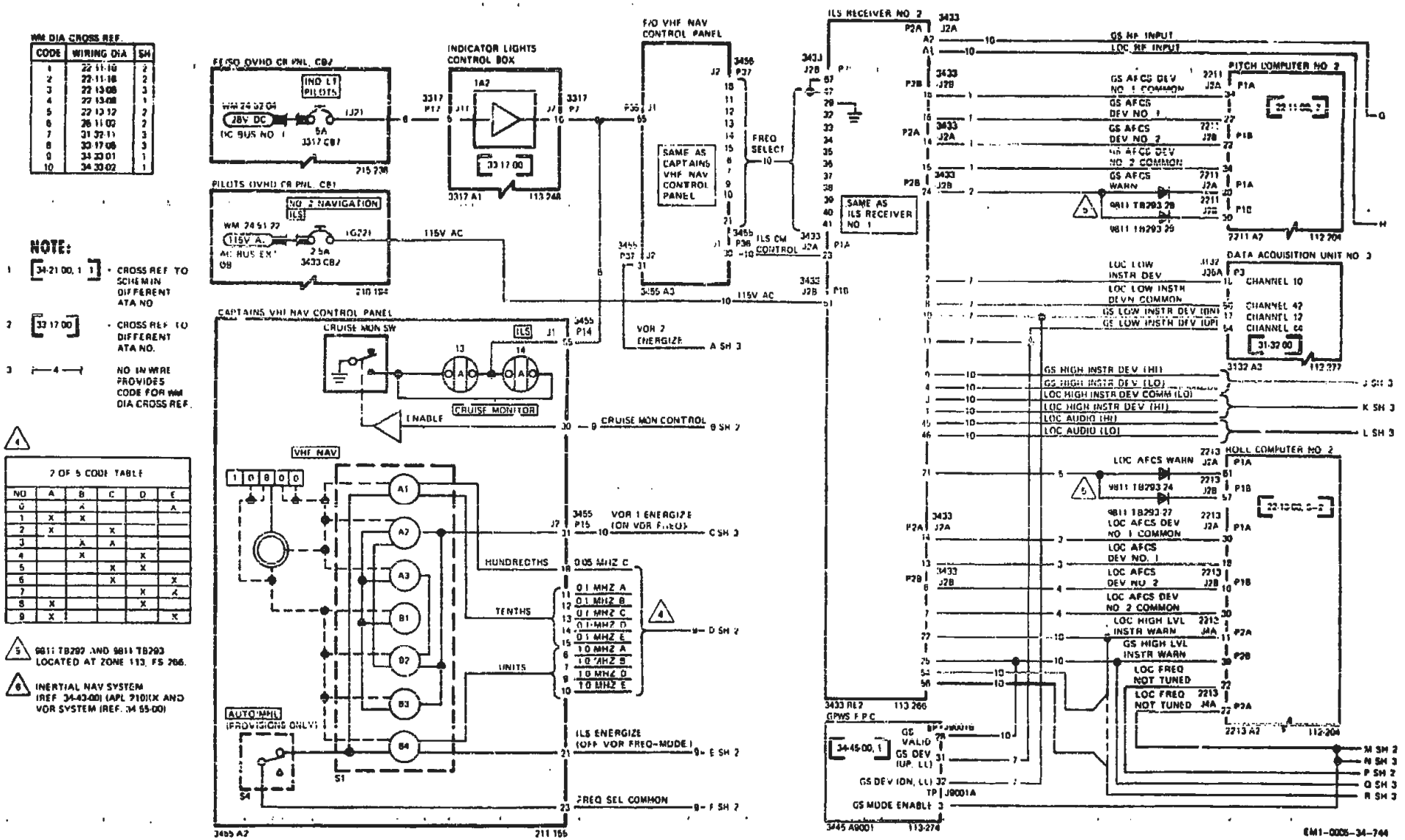
EFFECTIVITY: 001-024, 027



CR Instrument Landing System (ADI) Schematic
CR SCHEM 1 (Sheet 5)

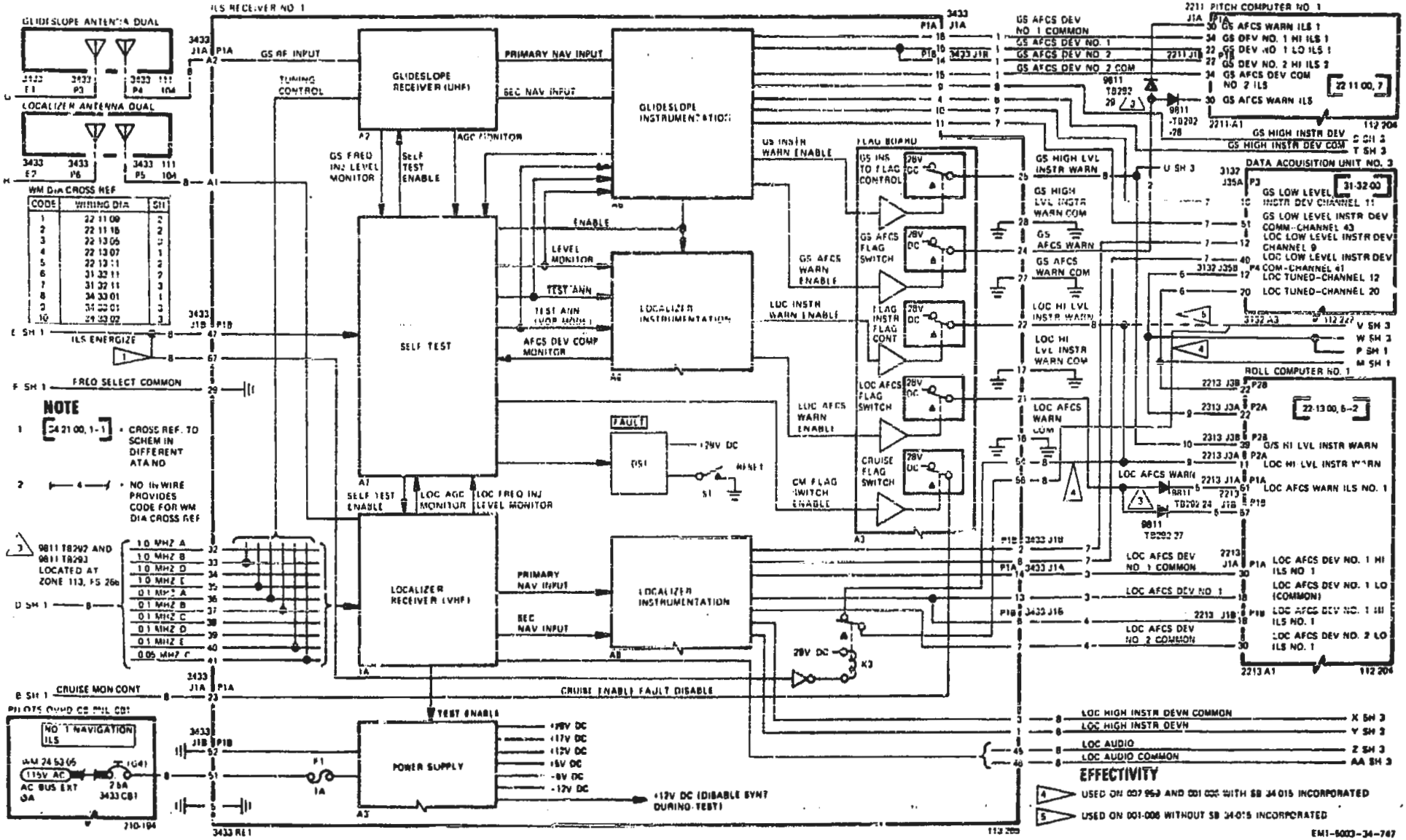
EFFECTIVITY: 001-024, 027

0018



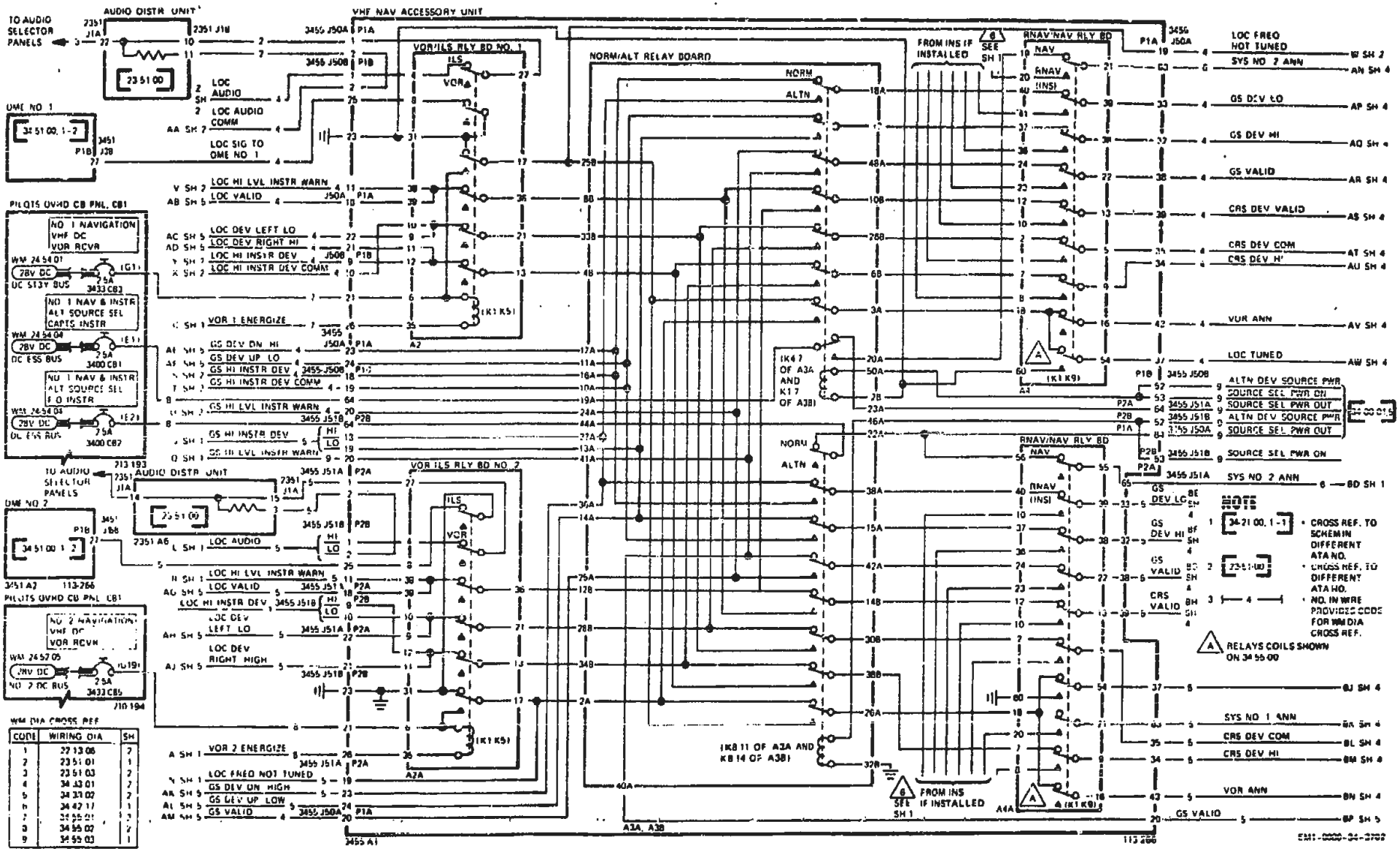
CR Instrument Landing System (ILS-1) Schematic
CR SCHEM 1 (Sheet 1)

EFFECTIVITY: 025, 026, 028-031


ILS RECEIVER NO 1
GLIDESLOPE ANTENNA DUAL
LOCALIZER ANTENNA DUAL
GS RF INPUT
TUNING CONTROL
GLIDESLOPE RECEIVER (UHF)
PRIMARY NAV INPUT
SEC NAV INPUT
GLIDESLOPE INSTRUMENTATION
AGC MONITOR
GS FREQ INJ LEVEL MONITOR
SELF TEST ENABLE
GS INSTR WARN ENABLE
FLAG BOARD
GS INS TO FLAG CONTROL
GS AFCS FLAG SWITCH
FLAG INSTR FLAG CONT
LOC AFCS FLAG SWITCH
CRUISE FLAG SWITCH
CM FLAG SWITCH ENABLE
ENABLE
LEVEL MONITOR
TEST ANN
TEST ANN (NOR MODE)
AFCS DEV COMP MONITOR
LOC INSTR WARN ENABLE
GS AFCS WARN ENABLE
LOC AFCS WARN ENABLE
SELF TEST
ILS ENERGIZE
FREQ SELECT COMMON
FAULT
DS1
RESET
S1
28V DC
SELF TEST ENABLE
LOC AGC MONITOR
LOC FREQ INJ LEVEL MONITOR
LOCALIZER RECEIVER (VHF)
PRIMARY NAV INPUT
SEC NAV INPUT
LOCALIZER INSTRUMENTATION
K3
CRUISE MON CONT
CRUISE ENABLE FAULT DISABLE
TEST ENABLE
POWER SUPPLY
+28V DC
+17V DC
+15V DC
+5V DC
-8V DC
-12V DC
+12V DC (DISABLE SYNT DURING TEST)
F1
1A
115V AC
AC BUS EXT
3A
7.5A
3433 CB1
NO 1 NAVIGATION ILS
WM 24 52 05
GS AFCS DEV NO 1 COMMON
GS AFCS DEV NO 1
GS AFCS DEV NO 2
GS AFCS DEV NO 2 COM
2211 PITCH COMPUTER NO 1
GS AFCS WARN ILS 1
GS DEV NO 1 HI ILS 1
GS DEV NO 1 LO ILS 1
GS DEV NO 2 HI ILS 2
GS AFCS DEV COM NO 2 ILS
GS AFCS WARN ILS
GS HIGH INSTR DEV
GS HIGH INSTR DEV COM
DATA ACQUISITION UNIT NO 3
GS LOW LEVEL INSTR DEV CHANNEL 11
GS LOW LEVEL INSTR DEV COMN-CHANNEL 43
LOC LOW LEVEL INSTR DEV CHANNEL 9
LOC LOW LEVEL INSTR DEV COM-CHANNEL 41
LOC TUNED-CHANNEL 12
LOC TUNED-CHANNEL 20
GS HIGH LVL INSTR WARN
GS HIGH LVL INSTR WARN COM
GS AFCS WARN
GS AFCS WARN COM
LOC HI LVL INSTR WARN
LOC HI LVL INSTR WARN COM
LOC AFCS WARN
LOC AFCS WARN COM
ROLL COMPUTER NO 1
G/S HI LVL INSTR WARN
LOC HI LVL INSTR WARN
LOC AFCS WARN ILS NO 1
LOC AFCS DEV NO 1 COMMON
LOC AFCS DEV NO 1
LOC AFCS DEV NO 2 COMMON
LOC AFCS DEV NO 1 HI ILS NO 1
LOC AFCS DEV NO 1 LO (COMMON)
LOC AFCS DEV NO 1 HI ILS NO 1
LOC AFCS DEV NO 2 LO ILS NO 1
LOC HIGH INSTR DEVN COMMON
LOC HIGH INSTR DEVN
LOC AUDIO
LOC AUDIO COMMON
EFFECTIVITY
4 USED ON 007 959 AND 001 005 WITH SB 34-015 INCORPORATED
5 USED ON 001-006 WITHOUT SB 34-015 INCORPORATED
NOTE
1 CROSS REF TO SCHEM IN DIFFERENT ATA NO
2 NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
3 9811 TB292 AND 9811 TB293 LOCATED AT ZONE 113, FS 266
WM DIA CROSS REF
CODE | WIRING DIA | SIZE
10 MHZ A
10 MHZ B
10 MHZ D
10 MHZ E
0.1 MHZ A
0.1 MHZ B
0.1 MHZ C
0.1 MHZ D
0.1 MHZ E
0.05 MHZ C
EM1-6003-34-747

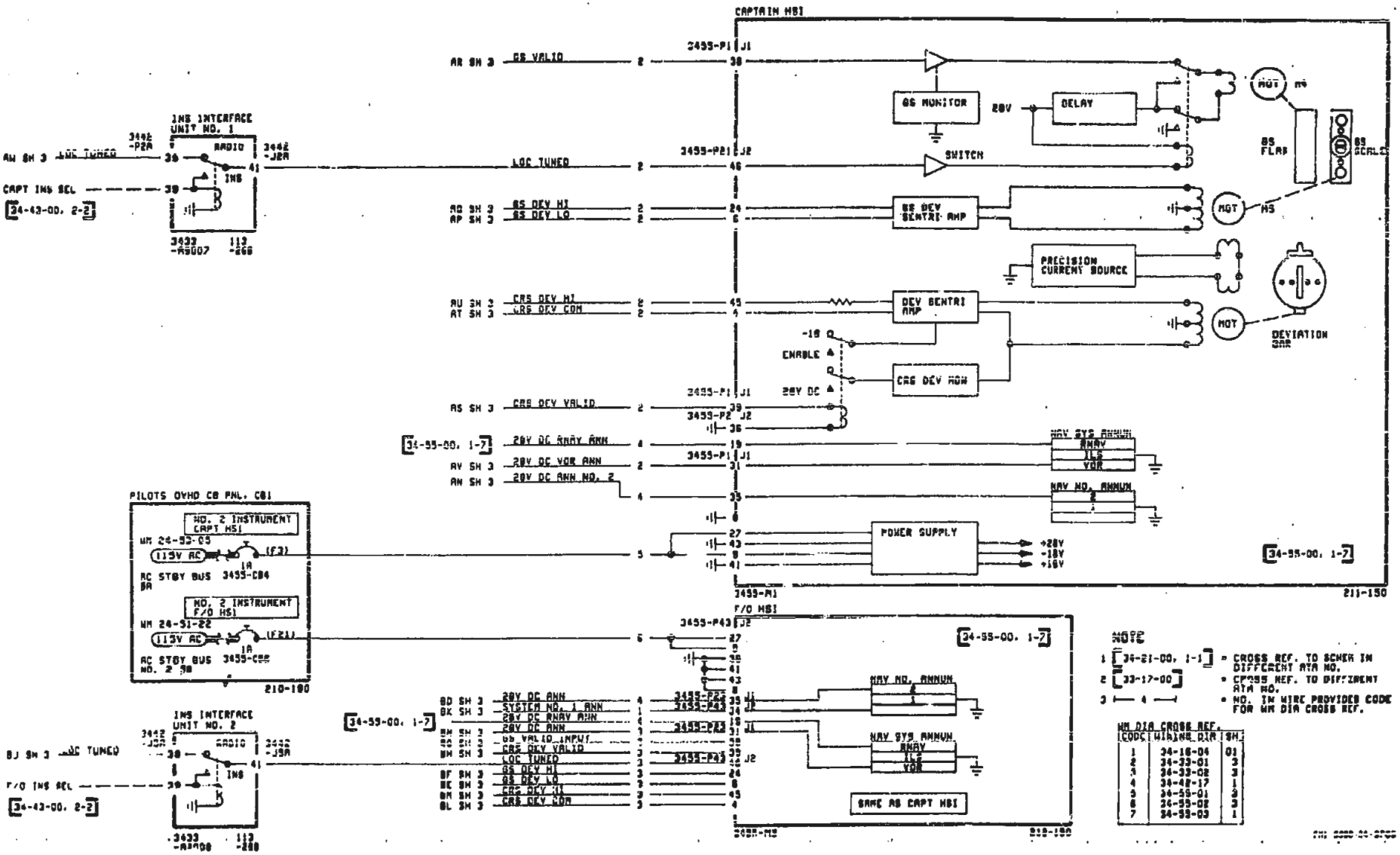
CR Instrument Landing System (ILS-2) Schematic
CR SCHEM 1 (Sheet 2)

R EFFECTIVITY: 025, 026, 028-031
R
0018


TO AUDIO SELECTOR PANELS
AUDIO DISTR UNIT
VHF NAV ACCESSORY UNIT
VOR/ILS RLY BD NO. 1
NORM/ALT RELAY BOARD
FROM INS IF INSTALLED
RNAV/NAV RLY BD
LOC FREQ NOT TUNED
SYS NO 2 ANN
GS DEV LO
GS DEV HI
GS VALID
CRS DEV VALID
CRS DEV COM
CRS DEV HI
VOR ANN
LOC TUNED
ALTN DEV SOURCE PWR
SOURCE SEL PWR ON
SOURCE SEL PWR OUT
LOC AUDIO
LOC AUDIO COMM
LOC SIG TO OME NO 1
LOC HI LVL INSTR WARN
LOC VALID
LOC DEV LEFT LO
LOC DEV RIGHT HI
LOC HI INSTR DEV
LOC HI INSTR DEV COMM
VOR 1 ENERGIZE
GS DEV DN HI
GS DEV UP LO
GS HI INSTR DEV
GS HI INSTR DEV COMM
GS HI LVL INSTR WARN
GS HI INSTR DEV
GS HI LVL INSTR WARN
VOR/ILS RLY BD NO. 2
VOR 2 ENERGIZE
LOC FREQ NOT TUNED
GS DEV DN HIGH
GS DEV UP LOW
GS VALID
PILOTS OVHD CB PNL, CB1
NO 1 NAVIGATION VHF DC VOR RCVR
NO 1 NAV & INSTR ALT SOURCE SEL CAPTS INSTR
NO 1 NAV & INSTR ALT SOURCE SEL F O INSTR
28V DC BUS
OME NO 1
OME NO 2
PILOTS OVHD CB PNL, CB1
NO 2 NAVIGATION VHF DC VOR RCVR
28V DC
NO 2 DC BUS
WM DIA CROSS REF
CODE
WIRING DIA
SH
NOTE
CROSS REF. TO SCHEMIN DIFFERENT ATA NO.
CROSS REF. TO DIFFERENT ATA NO.
NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
RELAYS COILS SHOWN ON 34-55-00
SEE SH 1
FROM INS IF INSTALLED
(K8 11 OF A3A AND K8 14 OF A3B)
(K4 7 OF A3A AND K17 OF A3B)

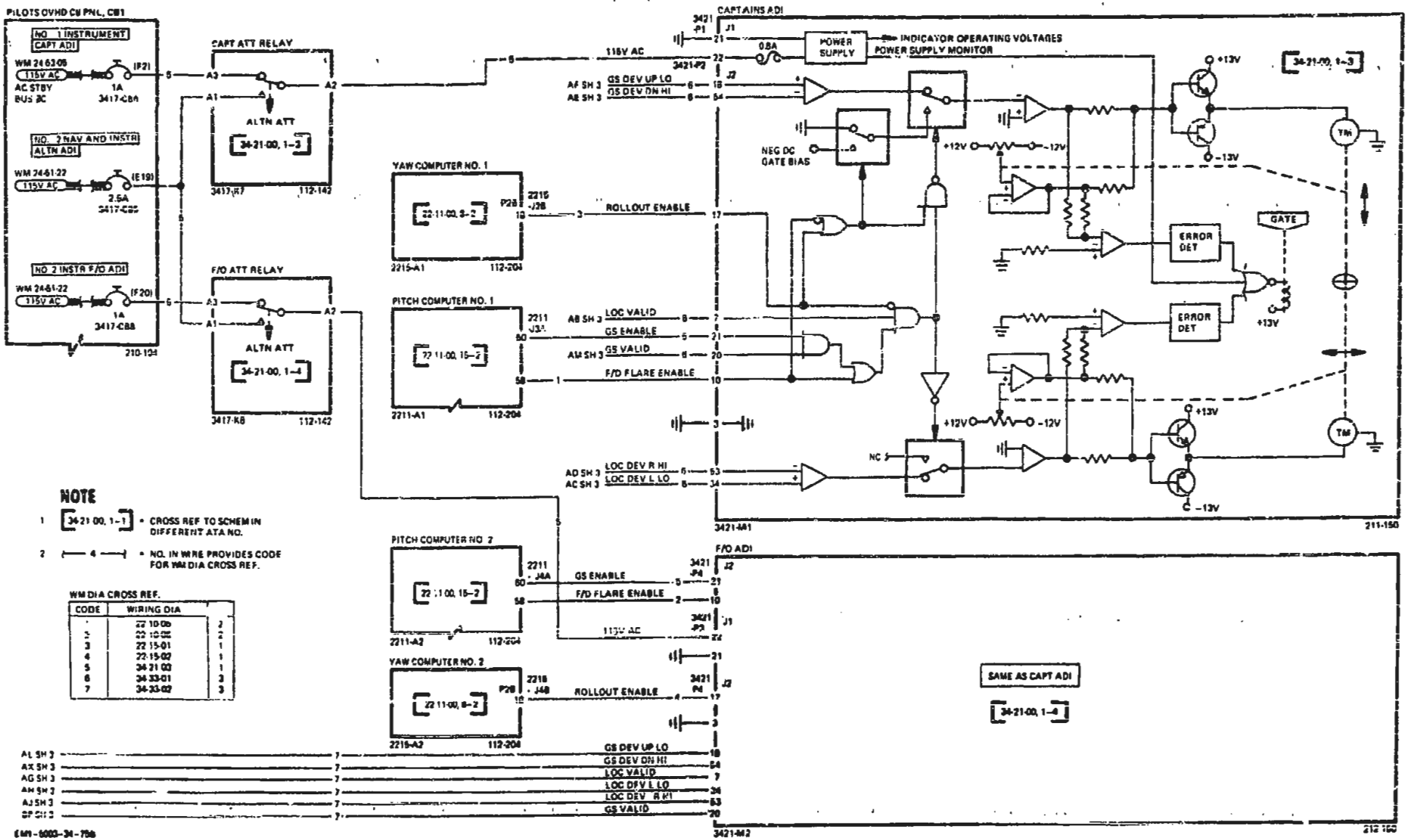
CR Instrument Landing System (VHF NAV Access Unit) Schematic
CR SCHEM 1 (Sheet 3)

R EFFECTIVITY: 025, 026, 028-031
R
0018



CR Instrument Landing System (HSI) Schematic
CR SCHEM 1 (Sheet 4)

R EFFECTIVITY: 025, 026, 028-031
R
0018



NOTE

1 [34-21-00, 1-1] = CROSS REF TO SCHEM IN DIFFERENT ATA NO.

2 —— 4 —— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

WM DIA CROSS REF.

CODE	WIRING DIA	
2	22-10-06	2
3	22-15-01	1
4	22-15-02	1
5	34-21-03	1
6	34-33-01	3
7	34-33-02	3

CR Instrument Landing System (ADI) Schematic
CR SCHEM 1 (Sheet 5)

R EFFECTIVITY: 025, 026, 028-031
R
0018

C INSTRUMENT LANDING SYSTEM - ADJUSTMENT AND TEST

C 1. Equipment and Materials

C Test Set, TIC-30, or equivalent

C Test Set, CRM-555 or equivalent.

C NOTE: Procedure reflects above test sets. If different test
C set is used; follow operating instructions supplied with
C test set in use.

C NOTE: To prevent interference with navigational facilities the
C CRM-555 will be used on a frequency of 108.00 MHz, for
C routine VOR testing and 108.10 MHz for routine LOCALIZER
C testing. Other frequencies may be used where
C circumstances demand. See instructions with test unit.
C It is recommended that the unit not be used on same
C frequencies as local navigation facilities. Unit may be
C self-tested by placing meter switch in SELF-TEST-ILS/VOR
CR position. Place DDM switch to 0 . Select GLIDE-PATH and
C LOCALIZER with function switch. Meter should read in
C blue SELF-TEST area. Place BEARING switch to 0 . Select
C VOR with function switch. Meter should read in blue
C SELF-TEST area.

C 2. Referenced Procedure

C 24-00-00 Electrical Power - Maintenance Practices

C 3. Adjustment/Test

C A. Prepare for Test

C (1) Turn on electrical power (Ref. 24-00-00).

C (2) On FE/SO-ECS MONITOR panel, ensure AVIONIC AIR - FWD
C AND MID LO FLO lights are out.

C (3) On pilots overhead circuit breaker panel CB1, zone 210,
C verify that the following circuit breakers are closed:

C AUDIO CONT - CAPT & F/E (A12)

C AUDIO CONT - F/O & OBS (A13)

C FLT INTPH AMPL (A14)

C CAPT ADI (F2)

C CAPT HSI (F3)

C F/O ADI (F20)

C F/O HSI (F21)

C ILS (G4)

C ILS (G22)

C (4) On FE/SO aft circuit breaker panel CB3, zone 215,
C verify that the following circuit breakers are closed:

C AUDIO CONT - CAPT & FE (C16)

CR AUDIO CONT - F/O OBS & FESC (C17)

C AUDIO CONT - FLT INTPH AMPL (C18)

C B. Operationally Test LOC System (Using Ramp-Test Unit)

C CAUTION: THE TESTER MUST NOT BE USED IN THE COCKPIT NOR
C USED AT A LOCATION CLOSER THAN 25 FEET FROM THE
C AIRCRAFT

C NOTE: Interphone communication between a cockpit observer
C and the person manipulating the tester is required to
C insure desired test results.

C NOTE: On Captains and F/O INSTRUMENT SOURCE SELECT panels,
C verify ALTN DEV switchlight is out. If on, depress
C and release applicable switchlight, extinguishing
C ALTN legend.

C NOTE: Set NAV MODE panel COURSE to aircraft heading.

C (1) Turn on CRM-555 Test Unit and allow it to warm up for
C at least three minutes.

C (2) Select the local authorized test frequency (normally
C 108.10 MHz) on the VOR control unit.

C (3) Apply a standard ON-COURSE localizer signal, using the
C ramp-test unit. The deviation needle in the HSI should
C be centered = one needle width. The pointers in each
C RMI will be inoperative. The fail flag should be
C RETRACTED FROM VIEW.

C (4) Apply a FLY-LEFT signal and observe that the deviation
C needle follows smoothly. Repeat for FLY-RIGHT.

C (5) Select VOR on at least one audio selector panel and C verify that localizer audio is present.

C (6) Remove or attenuate the test signal. The fail flag C should APPEAR in the HSI.

C (7) If no further need exists remove power from the C aircraft and the test equipment.

C C. Operationally Test GS System Using Ramp-Test Unit

C CAUTION: THE TEST MUST NOT BE USED IN THE COCKPIT NOR USED C AT A LOCATION CLOSER THAN 25 FEET FROM THE C AIRCRAFT!

C NOTE: Interphone communication between a cockpit observer C and the person manipulating the tester is required to C insure desired test results.

C (1) Turn on the CRM-555 Test Unit and allow it to warm up C for at least 3 minutes.

C (2) Select 108.10 MHz on the VHF/VOR control unit.

C (3) Apply a standard ON-COURSE glide slope signal using the C ramp test unit. The GS deviation needle in the HSI C should be centered ± one needle width, and the fail C flag should be RETRACTED FROM VIEW.

C (4) Apply a FLY-UP signal and observe that the deviation C needle follows smoothly. Repeat for FLY-DOWN.

C (5) Remove or attenuate the test signal. The GS fail flag C should appear in the HSI.

C (6) Select a VOR frequency on the VOR control unit. The GS C needle should be driven to maximum FLY-UP and the GS C flag should be RETRACTED FROM VIEW.

C (7) If no further need exists remove power from the C aircraft and test equipment.

C D. Functional Test ILS System (CRM-555 Tester Only)

C CAUTION: THE TEST MUST NOT BE USED IN THE COCKPIT NOR USED C AT A LOCATION CLOSER THAN 25 FEET FROM THE C AIRCRAFT!

C NOTE: Interphone communication between the cockpit observer C and the person manipulating the tester is required to C insure desired test results. On Captain and F/O C INSTRUMENT SOURCE SELECT panels, verify ALTN DEV

switchlight is out. If on, depress and release applicable switchlight, extinguishing ALTN legend.

The following steps check the LOCALIZER function of the ILS System.

Set NAV MODE panel COURSE to aircraft heading.

(1) Select a frequency of 108.10 MHz on the test unit. Set the FUNCTION selector to LOCALIZER position. Select "0" with the DDM selector switch. (DDM-Difference in Depth of Modulation of 90 and 150 CPS Signals).

(2) Tune the No. 1 and No. 2 VOR channel selectors to the frequency of 108.10 MHz. Turn the A/P-F/D course knobs until the course inverted "T" is in line with the lubberline at the top of the HSI indicator.

(3) Observe that the vertical deviation pointer in both the No. 1 and No. 2 HSI is centered ± 5 microamp. (5 microamp is approximately 1 needle width), and the warning flags are OUT OF SIGHT.

(4) Set the DDM selector switch on test unit to 4.0 DB FLY RIGHT. The deviation pointer in both HSI's should indicate FLY RIGHT and be between the first and second dots on the HSI indicator. Select 6.6 DB FLY RIGHT and the pointers should move to approximately the second dot to the RIGHT. Repeat for FLY LEFT.

(5) Pull the No. 1 NAVIGATION ILS circuit breaker on the overhead panel. The NAV flag in the Captain's HSI should COME INTO VIEW. Depress Captain's ALTN DEV switchlight.

(6) On the test unit select VARIABLE position with DDM selector and with variable control select FLY RIGHT and then FLY LEFT. Observe that the Captain's vertical deviation pointer follows the F/O pointer and both pointers will center with the variable scale centered. Pull the NO. 2 NAVIGATION ILS circuit breaker on the overhead panel. The NAV flag in both HSI's should appear. Push in the No. 1 NAVIGATION ILS circuit breakers. Depress the Captain's ALTN DEV switchlight.

(7) Depress the F/O's ALTN DEV switchlight. On the test unit select FLY RIGHT and FLY LEFT. Observe that the F/O's and Captain's vertical deviation pointer follows the FLY LEFT and FLY RIGHT command and both pointers will center with the variable scale centered. Pull the No. 1 NAVIGATION ILS circuit breaker on the overhead panel. The NAV flag in both HSI's should appear. Push

CR C in the No. 1 and No. 2 NAVIGATION ILS circuit breaker and depress the F/O's ALTN DEV switchlight.

C C C C C (8) On the test unit select 12.4 DB FLY RIGHT with the DDM selector. The vertical deviation pointer in both the No. 1 and No. 2 HSI indicators should go full scale to the RIGHT and warning flag should REMAIN OUT OF VIEW. Repeat for FLY LEFT. Return the DDM selector to "0".

C C C C C (9) On the test unit operate the R.F. ATTENUATOR controls from 0 toward 110 until the NAV fail flag appears in both the No. 1 and No. 2 HSI. Return attenuation controls to zero. The fail flag should again RETRACT FROM VIEW.

C C C C C (10) Depress and set both VOR-1 and -2 controls and SPKR controls to mid-position on audio select panels in flight station. Test unit audio will be heard through flight station speakers. Repeat at each audio select panel location.

C C C C C (11) Set Captain's VHF NAV control panel to 108.00 (VOR frequency) and open circuit breaker No. 1 NAVIGATION ILS (G4) on pilots overhead circuit breaker panel CB1. CRUISE MONITOR light on Capt VHF NAV control panel comes ON.

C C (12) Close circuit breaker (G4), CRUISE MONITOR light on Capt VHF NAV control panel goes OUT.

C C C C (13) Set F/O VHF NAV control panel to 108.00 (VOR frequency) and open circuit breaker NO. 2 NAVIGATION ILS (G22) on pilots overhead circuit breaker panel CB1. CRUISE MONITOR light on F/O VHF NAV control panel comes ON.

C C (14) Close circuit breaker (G22), CRUISE MONITOR light on F/O VHF NAV control panel goes out.

C C NOTE: The following steps check the GLIDE SLOPE function of the ILS system.

C C C C (15) Select a frequency of 108.10 MHz on the test unit. Set the FUNCTION selector to GLIDEPATH. Set GLIDEPATH frequency to 334.7 MHz. Set DDM selector switch to 0.

C C (16) Tune the No. 1 and No. 2 VOR channel selectors to the frequency of 108.10 MHz.

C C C C C (17) Check that the GS fail flags are OUT OF VIEW on both the Captain's and F/O's HSI indicators. On the CRM-555 rotate the 0 to 110 RF ATTENUATOR control towards 110 until the GS fail flags come INTO VIEW in both the

C Captain's and F/O's HSI indicators. Rotate control
C back to 0, both flags should RETRACT FROM VIEW.

C (18) Observe that the Glide Slope deviation pointer in both
C the No. 1 and No. 2 HSI is centered ± 5 microamps. (5
C microamps is approximately 1 needle width), and the
C warning flags are out of sight.

C (19) Set the DDM selector switch on the unit to 2.0 DB FLY
C DOWN. The Glide Slope deviation pointers in both HSI's
C should deflect to approximately one dot down on the HSI
C indicator. Select 3.76 DB FLY DOWN and the pointers
C should move to approximately the second dot down.
C Repeat for FLY UP.

C (20) Pull the No. 1 NAVIGATION ILS circuit breaker on the
C overhead panel. The GS flag in the Captain's HSI
C should come into view. Depress the Captain's ALTN DEV
C switchlight. The GS flag in the Captain's HSI should
C go OUT OF VIEW.

C (21) Set the DDM selector switch on the test unit to
C VARIABLE position. With the variable control select
C FLY UP and then FLY DOWN. Observe that the Captain's
C horizontal deviation pointer follows the F/O's pointer
C and that both pointers will center with the variable
C scale centered. Pull the NO. 2 NAVIGATION ILS circuit
C breaker on the overhead panel. The GS flag in both
C HSI's should APPEAR. Push in the No. 1 and No. 2
C NAVIGATION ILS circuit breakers. Depress the Captain's
C ALTN DEV switchlight.

C (22) Depress the F/O's ALTN DEV switchlight. On the test
C unit select FLY UP then FLY DOWN. Observe that the
C F/O's and Captain's horizontal deviation pointer
C follows the FLY UP and FLY DOWN command and that both
C pointers will center with the variable scale centered.
C Pull the No. 1 NAVIGATION ILS circuit breaker on the
C overhead panel. The GS flag in both HIS's should
C APPEAR. Push in the No. 1 NAVIGATION ILS circuit
C breaker. Depress the F/O's ALTN DEV switchlight.

C (23) Check for security of electrical connectors and
C mounting of units of the LOC/VOR/GS Systems.

C (24) Turn the Test Unit power switch to OFF.

C (25) Determine whether there is a need for external power on
C the aircraft; and if not, remove the external power.

ILS RECEIVER - REMOVAL AND INSTALLATION

1. Referenced Procedure

   34-33-00 Instrument Landing System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION - ILS (G4) or NO. 2 NAVIGATION - ILS (G22).

      (2) Open access door 112AB and enter forward electronic service center, zone 112. Locate ILS receivers No. 1 and No. 2 in rear avionics rack, shelf 1 (Ref. Fig. 401).

      (3) Loosen knurled knobs securing receiver to mount and disengage clamps from hooks on receiver front panel.

      (4) Using handle, slide receiver forward in mount tray until rear connectors disengage from mating connector.

      (5) Remove receiver from mount.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Position receiver on mount and push receiver back, ensuring receiver connector and mating connector are properly aligned.

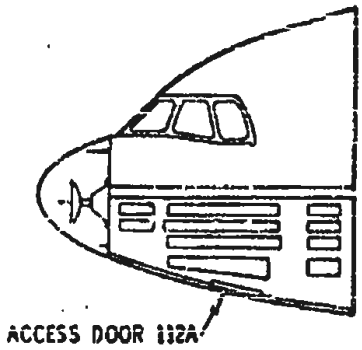
      (3) Place mount clamps over receiver hooks.

      (4) Tighten knurled knobs securing receiver to mount.

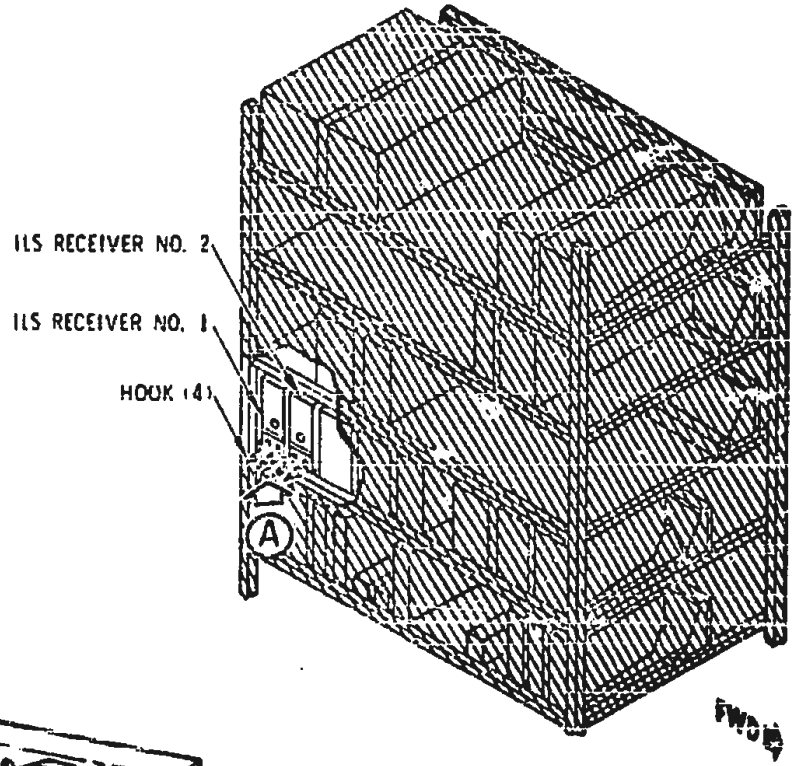
      (5) Close and secure access door.

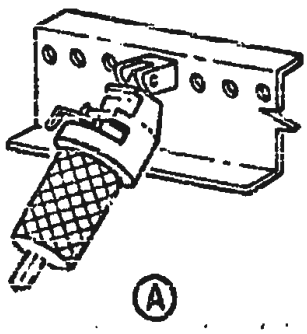
      (6) Remove tags and close circuit breakers opened in Step 2A(1).

      (7) Perform instrument landing system adjustment and test.



FESC REAR RACK, SHELF NO. 1





M1-0102-34-234

R
R

ILS Receivers - Removal and Installation
Figure 401

DUAL GLIDE SLOPE ANTENNA - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Solvent, Toluene TT-T-548 or equivalent

Clean cloth

R Teflon tape, MIL-I-235948, Type I, Pressure Sensitive

2. Removal/Installation

WARNING: ENSURE THAT WEATHER RADAR SYSTEM IS NOT OPERATING WHILE PERSONNEL ARE WORKING IN AREAS THAT ARE IN DIRECT PATH OF WEATHER RADAR ANTENNA RADIATION.

A. Removal

(1) Open radome, zone 111, by releasing latches and raising self-supporting hinged radome (Ref. Fig. 401).

(2) Remove bolts securing cover over dual glideslope antenna and remove cover.

(3) Remove bolts securing dual glideslope antenna to lower side of bulkhead.

(4) Slide antenna forward with coaxial cables attached.

R (5) Remove teflon tape, then disconnect and cap coaxial connectors from rear of antenna.

R (6) Remove antenna from aircraft.

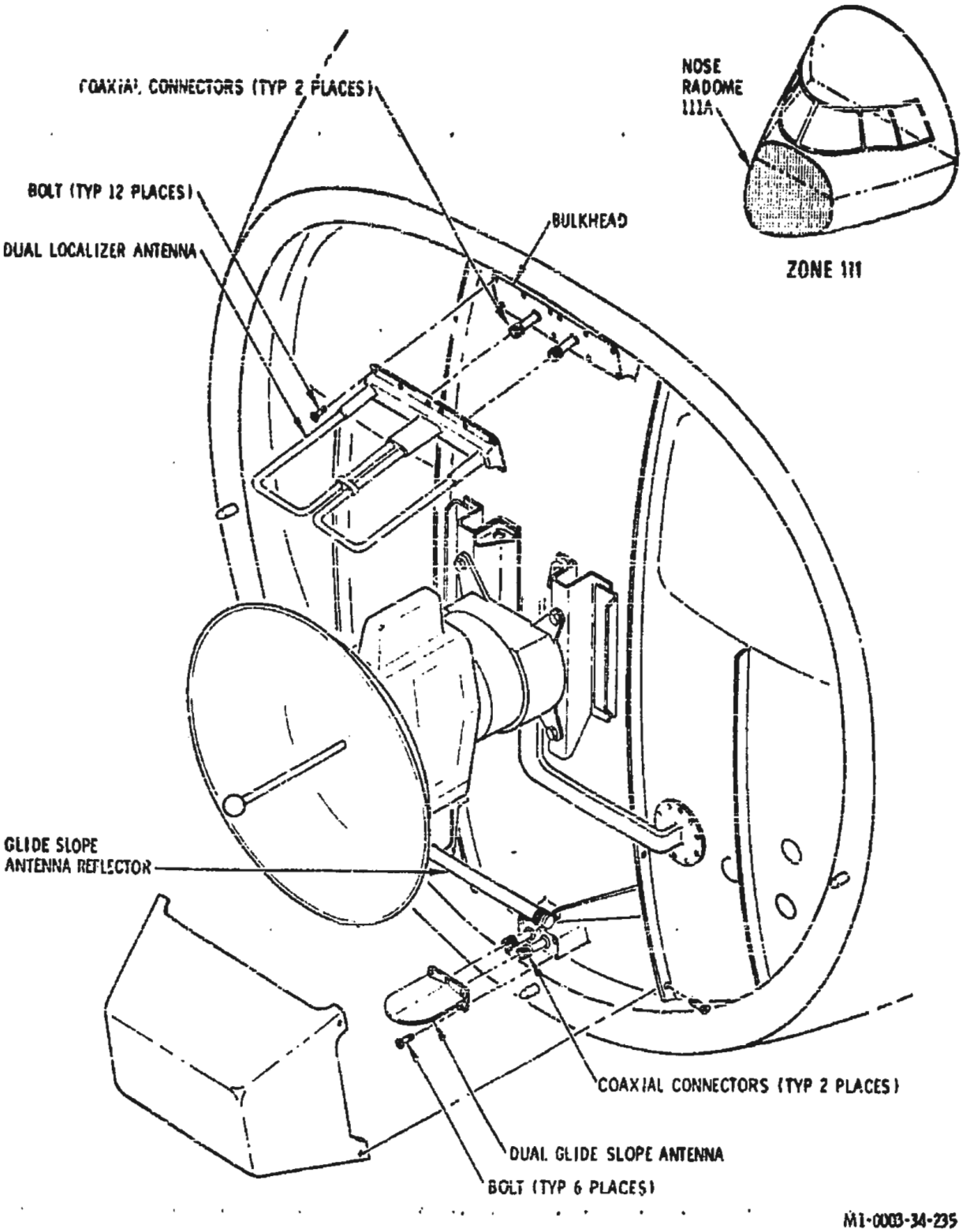
B. Installation

C C NOTE: Insure glideslope antenna reflector is in good condition and secure.

(1) Clean all mating surfaces.

(2) Remove caps from coaxial connectors.

R (3) Connect connectors to receptacles at rear of antenna.



CR Dual Glideslope Antenna - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B

WARNING: KEEP TOLUENE AWAY FROM HEAT, SPARKS AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

USE TOLUENE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN HEADACHE, DIZZINESS, NAUSEA, OR SKIN OR EYE IRRITATION.

R R (4) Clean connector surface with clean cloth dampened with Toluene TT-T-448.

R R (5) Wrap teflon tape (2 laps minimum) around connector applying tension to first lap only.

R (6) Slide coaxial cables attached to antenna into bulkhead.

R (7) Secure antenna to bulkhead with bolts.

R (8) Install cover over antenna and secure with bolts.

R (9) Lower radome to closed position.

R (10) Close and secure radome.

CR CR (11) Perform instrument landing system operational test procedure (Ref. 34-33-00).

DUAL LOCALIZER ANTENNA - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Solvent, Toluene TT-T-548 or equivalent

Clean Cloth

R Teflon tape, MIL-I-23594B, Type I, Pressure Sensitive

2. Removal/Installation

WARNING: ENSURE THAT WEATHER RADAR SYSTEM IS NOT OPERATING WHILE PERSONNEL ARE WORKING IN AREAS THAT ARE IN DIRECT PATH OF WEATHER RADAR ANTENNA RADIATION.

A. Removal

(1) Open radome, zone 111, by releasing latches and raising self-supporting hinged radome.

(2) Remove bolts securing dual localizer antenna to bulkhead (Ref. Fig. 401).

(3) Slide antenna forward with coaxial cables attached.

R (4) Remove teflon tape, then disconnect and cap coaxial connectors from rear of antenna.

R (5) Remove antenna from aircraft.

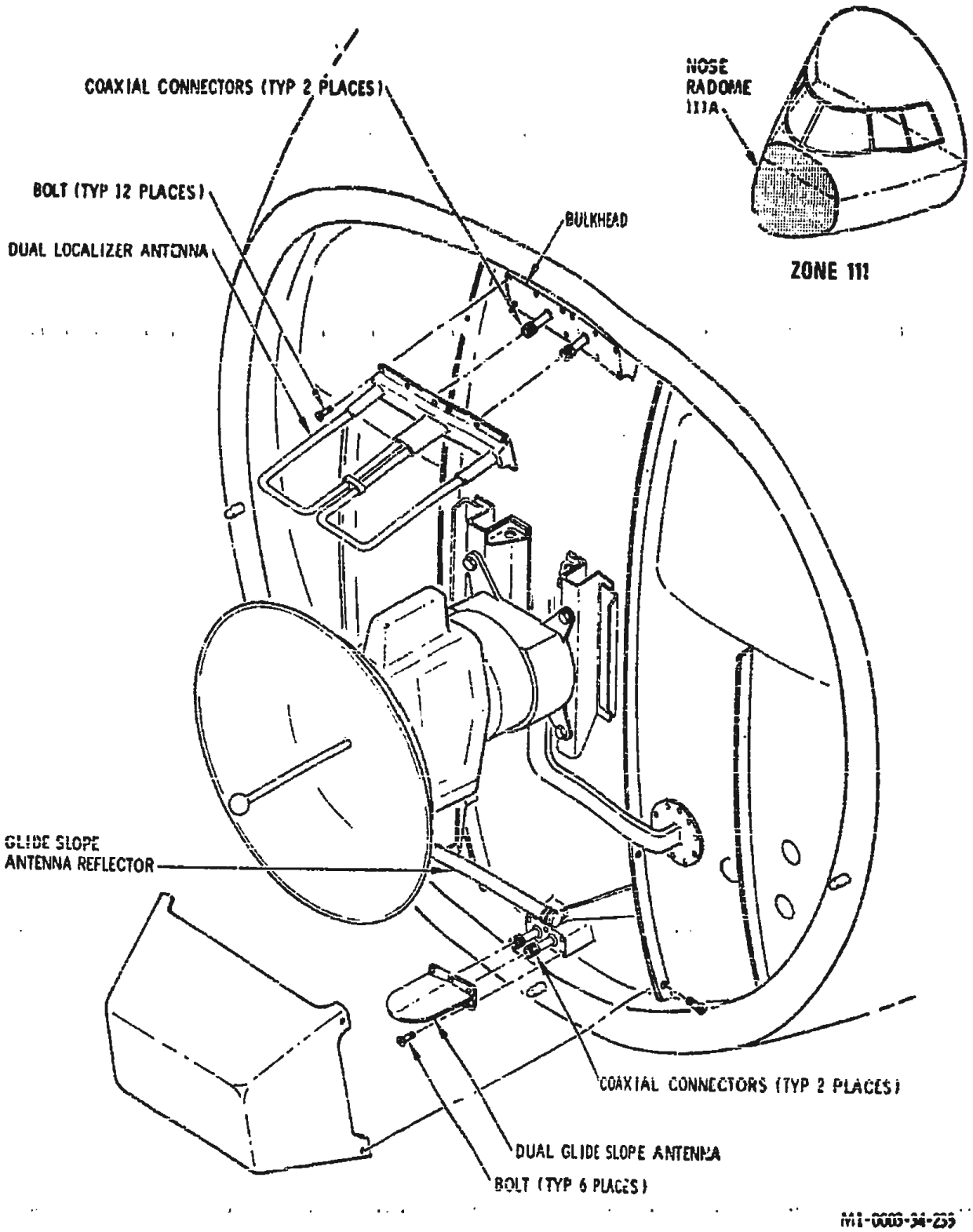
B. Installation

(1) Clean all mating surfaces.

(2) Remove caps from coaxial connectors.

R (3) Connect connectors to receptacles at rear of antenna.

CR (4) Perform an Operational Test of the LOC system using a
C ramp test unit (Ref. 34-33-00 instrument landing system
C adjustment test).



M1-0000-34-235

CR Dual Localizer Antenna - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

0018

WARNING: KEEP TOLUENE AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

USE TOLUENE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN HEADACHE, DIZZINESS, NAUSEA, OR SKIN OR EYE IRRITATION.

R (5) Clean connector surface with clean cloth dampened with Toluene solvent TT-T-548.

R (6) Wrap teflon tape (2 laps minimum) around connector applying tension to first lap only.

R (7) Slide coaxial cables attached to antenna into bulkhead.

R (8) Secure antenna to bulkhead with bolts.

R (9) Lower radome to closed position.

R (10) Close and secure radome.

R (11) Perform instrument landing system adjustment and test procedure (Ref. 34-33-00).

MARKER BEACON SYSTEM - DESCRIPTION AND OPERATION

1. General

The marker beacon system (Ref. Fig. 1) consists of a receiver, an antenna, five marker (MKR) audio controls, a sensitivity switch, two light assemblies and a set of three lights in each attitude director indicator (ADI) (Ref. 34-21-00). The receiver is located in the forward electronics service center, zone 113. The antenna is mounted on the bottom of the fuselage under the forward cargo compartment, zone 121. The five MKR audio controls are located, one each, on the five audio selector panels (Ref. 23-51-00). The receiver sensitivity (NORM/HI) switch is mounted on the SELCAL system control panel (Ref. 23-22-00). The light assemblies are located, one each, on the Captains and First Officers instrument panels; zones 211 and 212. Each light assembly contains one white, one amber, and one blue light placarded AIRWAYS, MIDDLE, and OUTER, respectively. A duplicate set of lights are provided in each ADI. Identically colored lights in both light assemblies and both ADIs are connected in parallel.

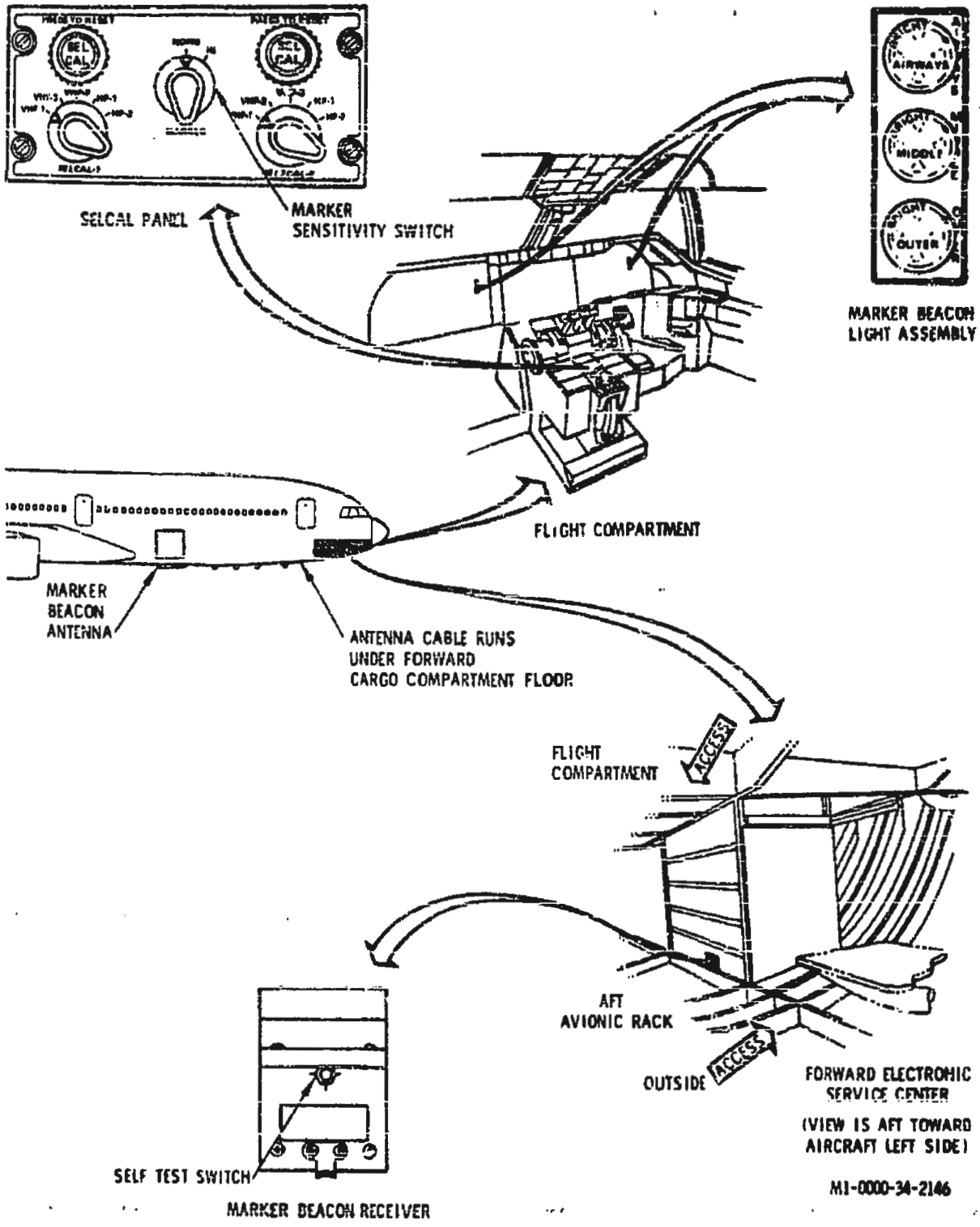
Space is provided for a second marker beacon system. The installed system is identified as Marker Beacon System No. 1.

The system (Ref. Fig. 2) consists of a transistorized, crystal controlled, single conversion, superheterodyne receiver
R operating at a fixed frequency of 75-MHz and its ancillary equipment. The system detects and differentiates the three marker beacon signals. Visual outputs are provided to the Captains and First Officers light assemblies and ADI. Audio outputs are provided to the audio distribution unit (Ref. 23-51-00).

The five MKR audio controls regulate the system audio output level. The TEST pushbutton switch on the receiver front panel permits checkout of the system.

2. Operation

The marker beacon system is enabled by providing power to the DC Essential Radio Bus (Ref. 24-00-00) and closing the NO. 1 NAVIGATION - MARKER BEACON (D7) circuit breaker on the pilots overhead circuit breaker panel CB1, zone 210. The system audio output level is adjusted using the MKR control on the applicable audio selector panel. The receiver sensitivity is selected using the MARKER - NORM/HI switch on the SELCAL control panel.



R
R

Marker Beacon System
Figure 1

EFFECTIVITY: ALL

001B

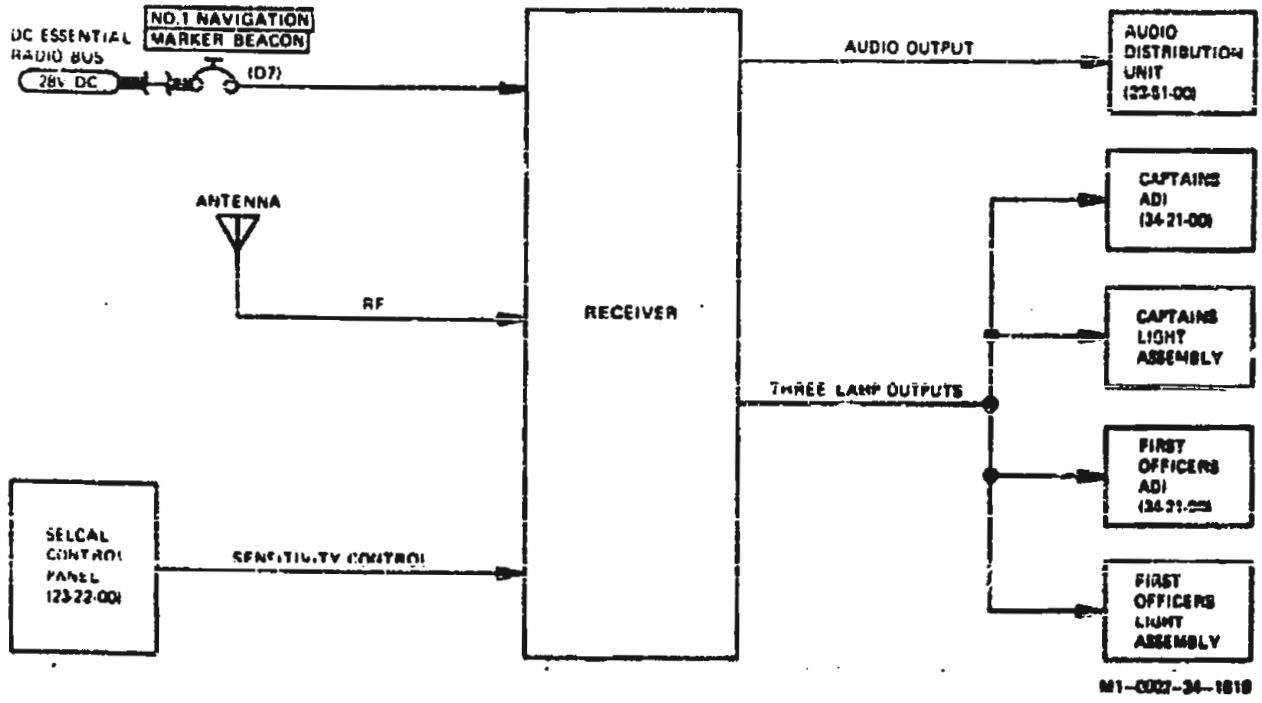
When the aircraft passes over a marker beacon, the system
R receives a 75-MHz signal amplitude-modulated at 400, 1300, or
R 3000-Hz for outer, middle, or airways marker, respectively. The receiver turns on the applicable colored indicator lamp on both the Captains light assembly and ADI and the First Officers light assembly and ADI.

The 400-Hz outer marker signal turns on the blue lamp. The 1300-Hz middle marker signal turns on the amber lamp. The 3000-Hz airways marker signal turns on the white lamp.

Each light assembly indicator cap is provided with an iris for brightness control. The receiver applies the marker identifying audio signal to the audio distribution unit (Ref. 23-51-00).

The marker beacon system has a self-test capability which is enabled by pressing the TEST switch on the receiver front panel.

The receiver is contained in a 1/4 ATR case. A single rear connector provides system interface. The receiver is unpressurized and is convection cooled. The receiver dust cover is secured by a quarter-turn fastener. The receiver is shock-mounted in the forward electronics service center, rear avionics rack, shelf No. 1, zone 113 and is secured by a single thumbscrew.



R Marker Beacon System Block Diagram
R Figure 2

3. Receiver

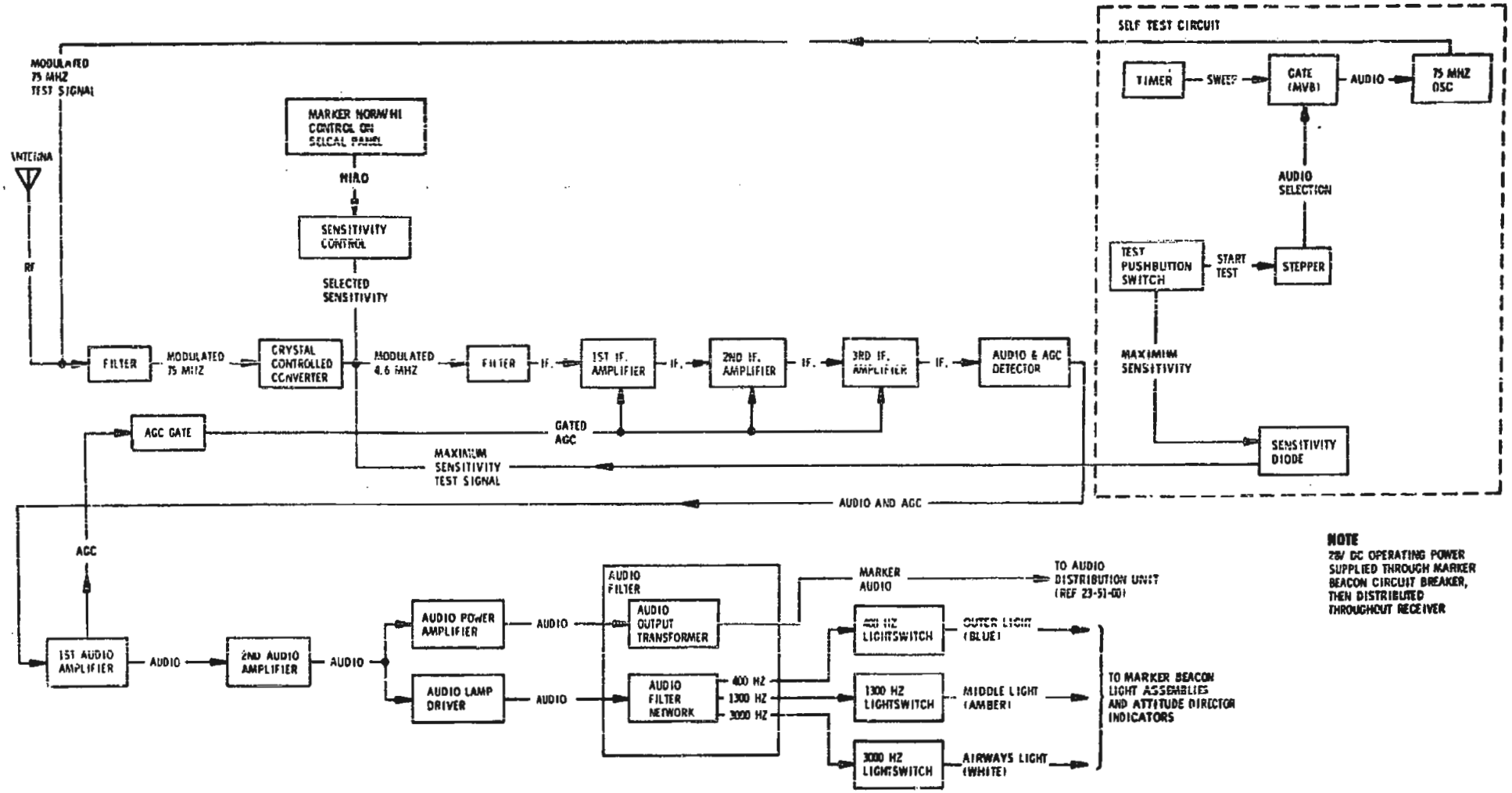
The receiver detects the 75-MHz signal when the aircraft passes over a marker beacon. Signal routing is shown in Figure 3. The received 75-MHz signal contains the 400, 1300, or 3000-Hz beacon modulation. Signals picked up by the antenna are applied through the input filter, which consists of three LC filters, inductively tuned to 75-MHz, to provide selectivity and image rejection and block the crystal oscillator signal of 70.4-MHz.

The 75-MHz signal is then applied to a crystal-controlled converter, which mixes it with the crystal oscillator signal. The IF is selected by an IF filter and applied to a three-stage IF amplifier. The IF amplifier increases the level of the 4.6-MHz IF signal and improves the receiver selectivity. The audio component (400, 1300, or 3000-Hz) of the IF signal is detected in a demodulator and applied to an audio amplifier. A second detector picks off a portion of the audio amplifier output signal and converts it to an AGC voltage. The AGC is then applied to the IF amplifier. The audio amplifier output signal drives the audio power amplifier and the audio lamp driver.

The lamp driver output is applied to three audio filter networks. The three audio filters are selective transformers tuned to 400, 1300, and 3000-Hz. When a signal is received, the associated primary winding resonates, and the light switch transistor connected to the secondary winding conducts, turning on the applicable marker lights.

Receiver sensitivity is controlled by a diode which shunts the output of the crystal-controlled converter. Gating of the diode is remotely controlled by the NORM and HI positions of the MARKER sensitivity switch on the SELCAL control panel to select the receiver sensitivity desired (Ref. 22-23-00).

The self-test circuit (Ref. Fig. 3) supplies the receiver with a 75-MHz modulated test signal. Self-test is actuated by depressing the TEST pushbutton switch on the receiver front panel. The self-test circuit consists of a timer, a multivibrator, a stepper, and an oscillator. When self-test is actuated, the timer drives the multivibrator, which modulates the 75-MHz oscillator. The stepper causes themultivibrator frequency to vary in three steps; 400, 1300, and 3000-Hz in a time period of approximately 5-seconds. This will cause the OUTER, MIDDLE, and AIRWAYS marker lamps to come on in sequence accompanied by the corresponding audio tone.



NOTE
28V DC OPERATING POWER SUPPLIED THROUGH MARKER BEACON CIRCUIT BREAKER, THEN DISTRIBUTED THROUGHOUT RECEIVER

MI-0001-34-1724

Marker Beacon Receiver Block Diagram
Figure 3

EFFECTIVITY: ALL

0018

4. Antenna

The marker beacon antenna is a canoe-shaped antenna. The antenna is secured to the bottom of the aircraft. Electrical connection to the antenna is made by a type-N coaxial connector located on the antenna base. The coaxial connection is weather-proofed by an O-ring located in a groove surrounding the coaxial connector.

R The antenna operates within the frequency range of 74.7-MHz to
R 75.3-MHz. It has a VSWR of 5.0 to 1 over the operating range
R with a maximum VSWR of 1.5 to 1 at 75-MHz.

R The antenna has a 52-ohm input impedance.

5. Light Assembly

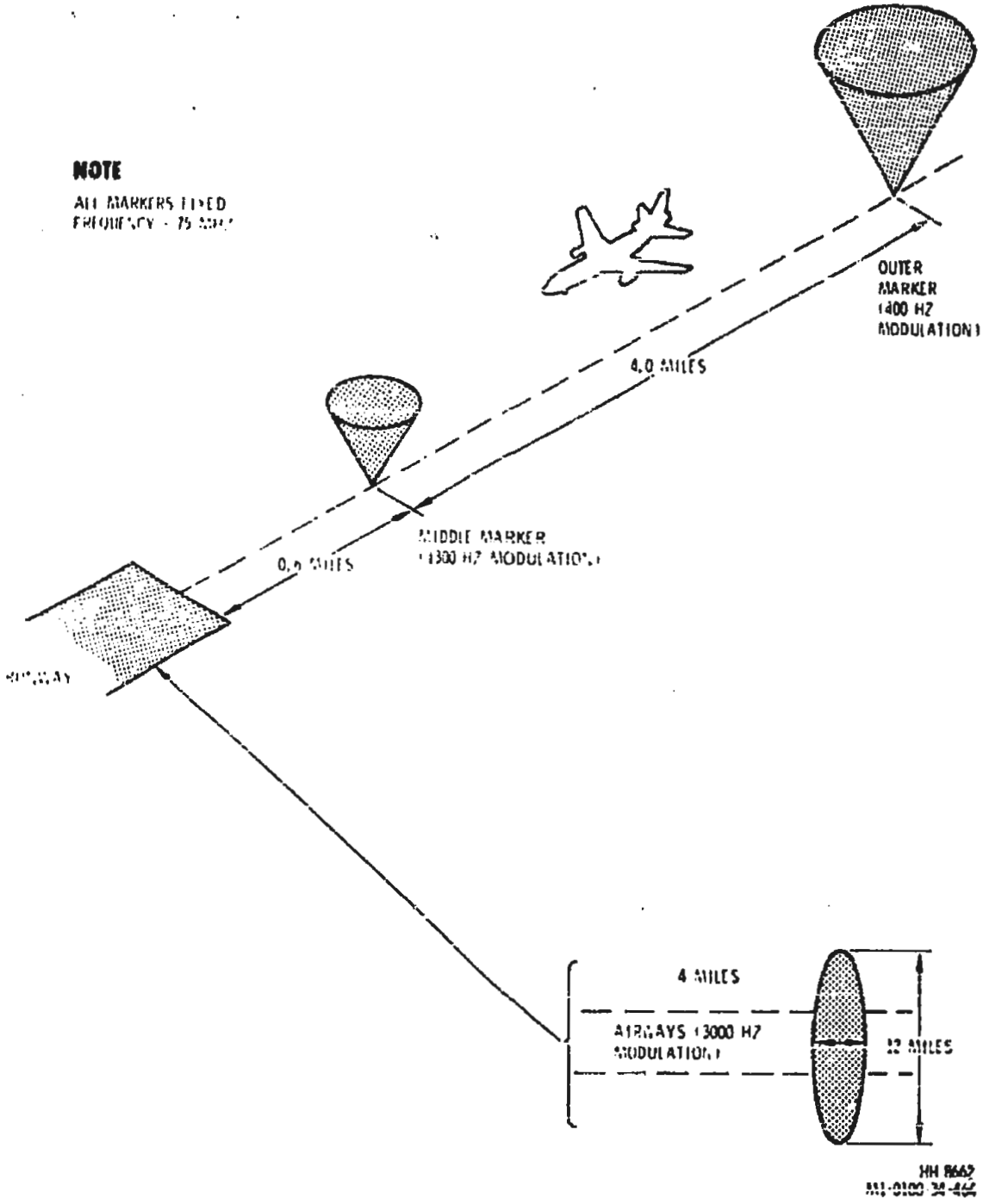
The light assembly contains three lamps with colored caps arranged vertically. One light assembly is located on the Captains instrument panel, zone 211, and a duplicate light assembly is located on the First Officers instrument panel, zone 212. The top indicator cap of each light assembly is colored white and placarded AIRWAYS. The middle indicator cap is colored amber and placarded MIDDLE. The bottom indicator cap is colored blue and placarded OUTER. Each indicator cap contains an iris to control brightness.

When the aircraft passes over the outer marker beacon, (Ref. Fig. 4) the OUTER indicators on the Captains and First Officers light assemblies come on. The OUTER indicators remain on while the aircraft is within the outer beacon cone. When the aircraft passes through the middle beacon cone, the MIDDLE indicators come on and remain on until the aircraft has passed through the middle beacon cone. When the aircraft passes over the airways beacon, the AIRWAYS indicators come on. During the time the aircraft is within the outer or middle marker cone, or the fan shaped airways beacon, a pulsating aural tone accompanies the visual indication.

Each indicator cap is rotated clockwise to increase brightness. Each indicator has a press-to-test feature to check out the indicator lamp.

R 6. To Operate

R The marker beacon receiver is in operation at all times when MARKER BEACON (D7) circuit breaker is closed on the pilots overhead circuit breaker panel, CB1, zone 210.



Marker Beacon Operation
Figure 4

MARKER BEACON SYSTEM - FAULT ISOLATION

1. General

R Reference data and fault isolation procedures are included in
R this section of the manual. A system malfunction detected by
R the flight crew is entered in the flight log book and reported
R to maintenance personnel by a FIRM fault code number. This
R number and the flight log book write-up can be found in the
R Chapter 34 Fault Code Index. The index specifies maintenance
R manual section, fault isolation diagram figure number, and block
R number on diagram where fault isolation procedure should start.

R Prerequisites listed at the top of each diagram identify
R mandatory preliminary steps and circuit breakers that must be
R closed before initiating any fault isolation step.

R Schematics are included at the end of this section to supplement
R fault isolation diagrams or as an aid in isolating a problem not
R covered on diagrams. The schematics show basic system circuitry
R necessary for troubleshooting and include cross-reference
R indexes to wiring diagram manual pages required for checking
R component interconnect wiring.

R Refer to Maintenance Manual Introduction for more detailed
R discussion of Fault Isolation Reporting Method (FIRM) and use of
R fault isolation diagrams/schematics.

2. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide marker beacon system and associated component locations.

Fault Isolation Diagrams and Schematics List
Table 101

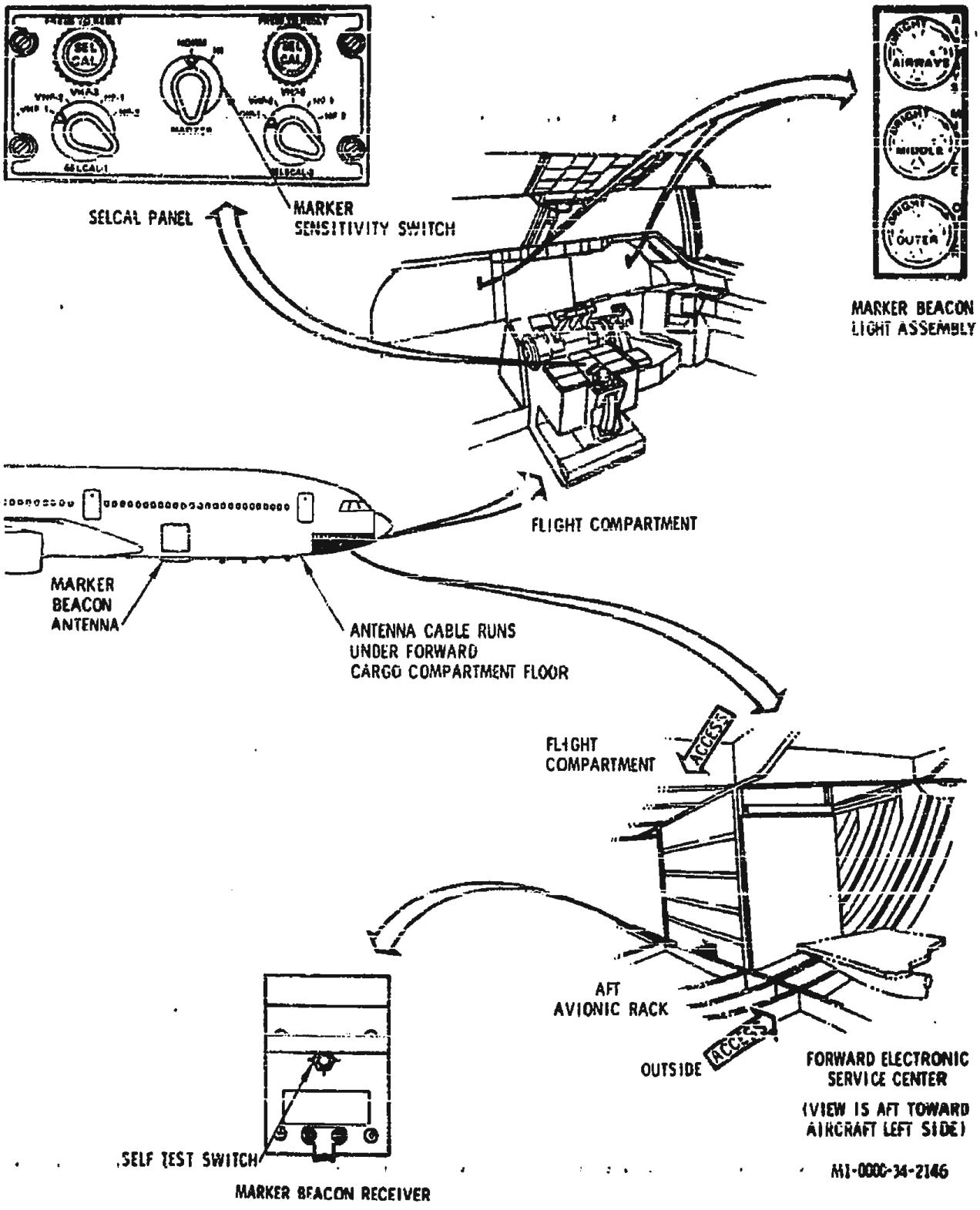
FIG. NO.	FAULT
101	Component Location Index
102	Component Locator Diagram
103	BITE test
104	Detailed Fault Isolation Test
SCHEM 1	Marker Beacon System Schematic

COMPONENT	QTY	ACCESS/AREA	REFERENCE
RECEIVER - MARKER BEACON	1	FESC; AFT AVIONIC RACK, SHELF 1, FORWARD END	34-35-01
ANTENNA - MARKER BEACON	1	LOWER FUSELAGE CENTERLINE UNDER FORWARD CARGO COMPARTMENT	34-35-02
LIGHT ASSEMBLY - MARKER BEACON	2	FLIGHT STATION; RIGHT SIDE OF CAPTAINS AND F/Os INSTRUMENT PANEL	34-35-03
PANEL - SELCAL (MKR SENS SWITCH)	1	FLIGHT STATION; ON CENTER CONSOLE	23-22-02

M1-0000-34-3184

Component Location Index
Figure 101

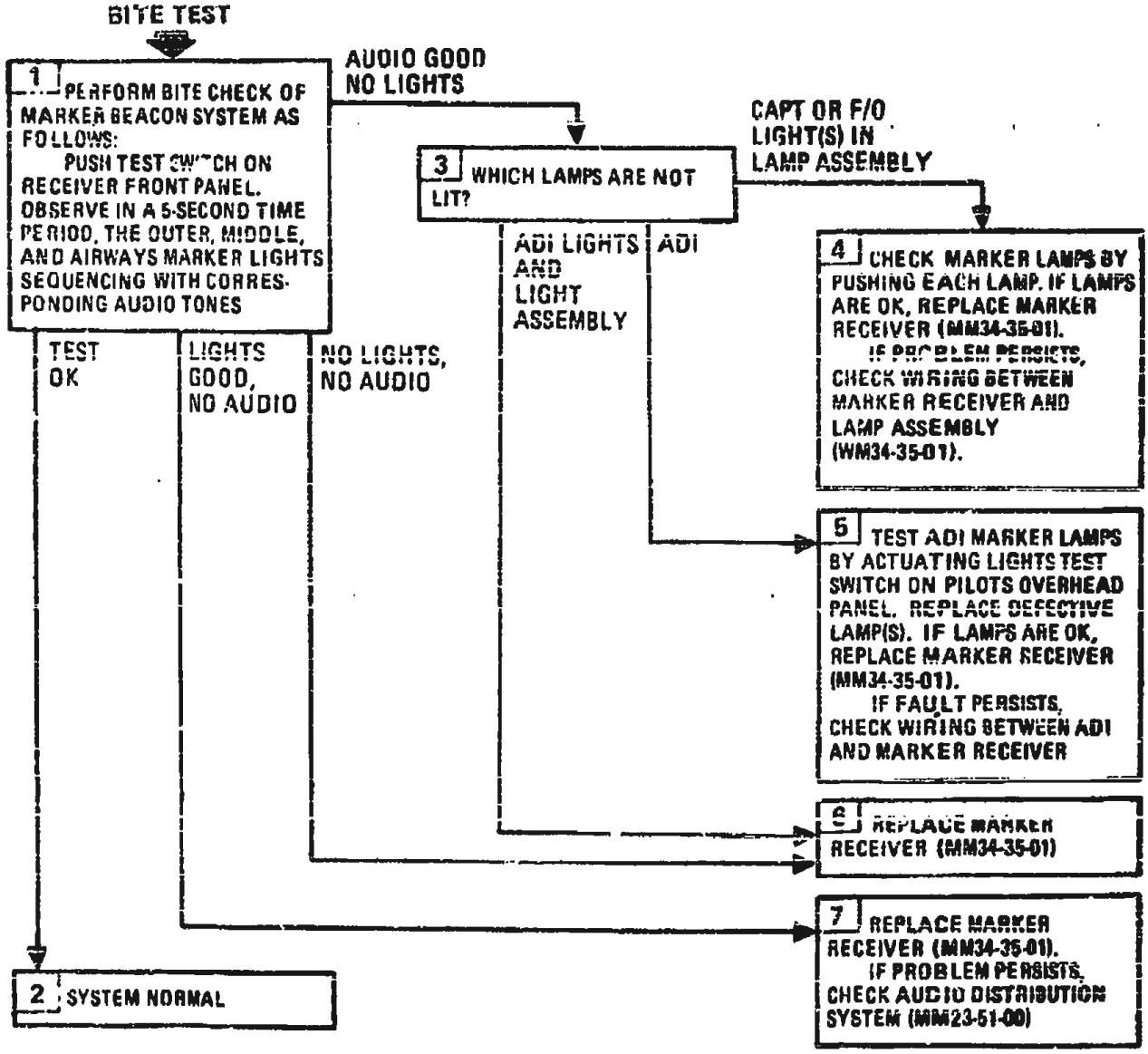
R EFFECTIVITY: ALL
R
001B



Component Locator
Figure 102

R EFFECTIVITY: ALL
R
0018

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR-FWD AND MID LO FLO LIGHTS ON FE/AO ECS MONITOR PANEL ARE OUT (MM21-26-00)
CB'S: 1A12, 1A13, 1A14, 107, 308
CAPT (F/O) AUDIO SELECT PANEL MKR AND SPKR CONTROLS DEPRESSED AND SET TO MID-POSITION
TWO MEN ARE REQUIRED, ONE IN FESC AND ONE IN FLIGHT COMPARTMENT

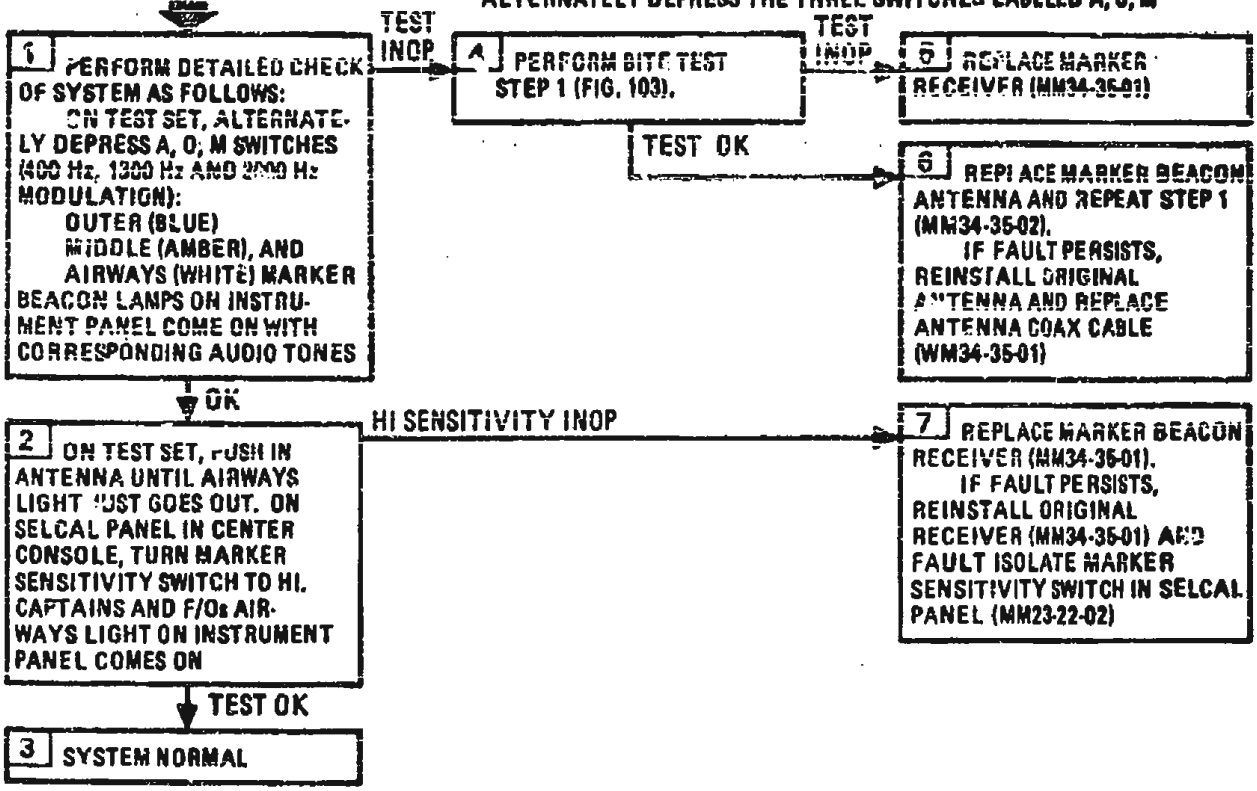

BITE TEST
1 PERFORM BITE CHECK OF MARKER BEACON SYSTEM AS FOLLOWS:
PUSH TEST SWITCH ON RECEIVER FRONT PANEL. OBSERVE IN A 5-SECOND TIME PERIOD, THE OUTER, MIDDLE, AND AIRWAYS MARKER LIGHTS SEQUENCING WITH CORRESPONDING AUDIO TONES
AUDIO GOOD NO LIGHTS
3 WHICH LAMPS ARE NOT LIT?
CAPT OR F/O LIGHT(S) IN LAMP ASSEMBLY
ADI LIGHTS AND LIGHT ASSEMBLY
ADI
4 CHECK MARKER LAMPS BY PUSHING EACH LAMP. IF LAMPS ARE OK, REPLACE MARKER RECEIVER (MM34-35-01).
IF PROBLEM PERSISTS, CHECK WIRING BETWEEN MARKER RECEIVER AND LAMP ASSEMBLY (WM34-35-01).
5 TEST ADI MARKER LAMPS BY ACTUATING LIGHTS TEST SWITCH ON PILOTS OVERHEAD PANEL. REPLACE DEFECTIVE LAMP(S). IF LAMPS ARE OK, REPLACE MARKER RECEIVER (MM34-35-01).
IF FAULT PERSISTS, CHECK WIRING BETWEEN ADI AND MARKER RECEIVER
TEST OK
LIGHTS GOOD, NO AUDIO
NO LIGHTS, NO AUDIO
6 REPLACE MARKER RECEIVER (MM34-35-01)
7 REPLACE MARKER RECEIVER (MM34-35-01).
IF PROBLEM PERSISTS, CHECK AUDIO DISTRIBUTION SYSTEM (MM23-51-00)
2 SYSTEM NORMAL

M1-5002-34-1733

Marker Beacon System BITE Test
Figure 103

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR–FWD AND MID LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT (MM21-25-00)
CB'S: 1A12, 1A13, 1A14, 1D7, 3G8
CAPT (F/O) AUDIO SELECT PANEL MKR AND SPKR CONTROLS DEPRESSED AND SET TO MID-POSITION
TIC-30 TEST SET
EXTEND MARKER BEACON ANTENNA
ALTERNATELY DEPRESS THE THREE SWITCHES LABELED A, O, M

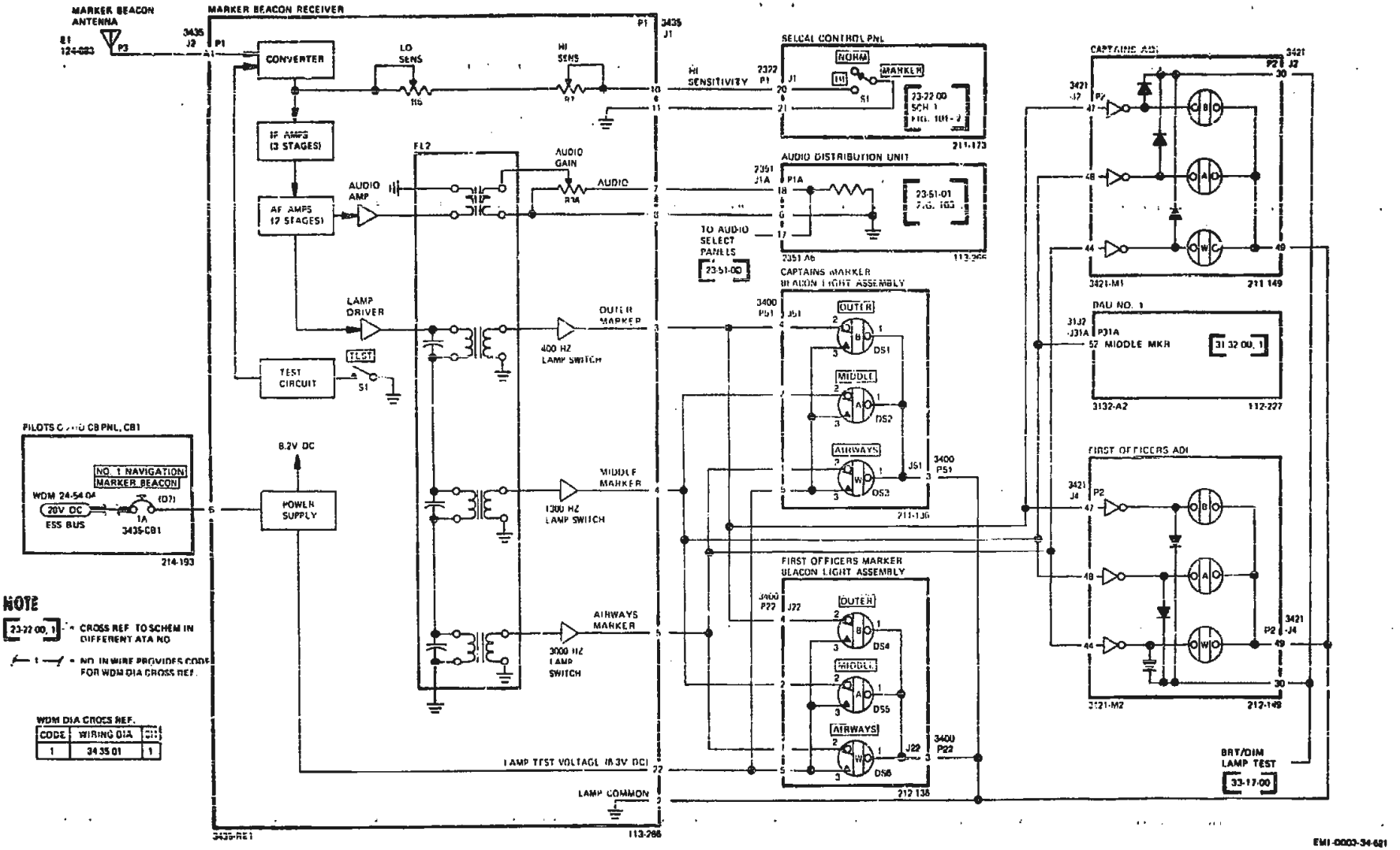

DETAILED TEST
1 PERFORM DETAILED CHECK OF SYSTEM AS FOLLOWS: ON TEST SET, ALTERNATELY DEPRESS A, O, M SWITCHES (400 Hz, 1300 Hz AND 2000 Hz MODULATION): OUTER (BLUE) MIDDLE (AMBER), AND AIRWAYS (WHITE) MARKER BEACON LAMPS ON INSTRUMENT PANEL COME ON WITH CORRESPONDING AUDIO TONES
TEST INOP
4 PERFORM BITE TEST STEP 1 (FIG. 103).
TEST INOP
5 REPLACE MARKER RECEIVER (MM34-35-01)
TEST OK
6 REPLACE MARKER BEACON ANTENNA AND REPEAT STEP 1 (MM34-35-02). IF FAULT PERSISTS, REINSTALL ORIGINAL ANTENNA AND REPLACE ANTENNA COAX CABLE (WM34-35-01)
OK
HI SENSITIVITY INOP
2 ON TEST SET, PUSH IN ANTENNA UNTIL AIRWAYS LIGHT JUST GOES OUT. ON SELCAL PANEL IN CENTER CONSOLE, TURN MARKER SENSITIVITY SWITCH TO HI. CAPTAINS AND F/Os AIRWAYS LIGHT ON INSTRUMENT PANEL COMES ON
7 REPLACE MARKER BEACON RECEIVER (MM34-35-01). IF FAULT PERSISTS, REINSTALL ORIGINAL RECEIVER (MM34-35-01) AND FAULT ISOLATE MARKER SENSITIVITY SWITCH IN SELCAL PANEL (MM23-22-02)
TEST OK
3 SYSTEM NORMAL

NOTE
START TEST WITH NORM–HI SENSITIVITY SWITCH ON SELCAL PANEL IN NORM POSITION

M1-0002-34-1741

C C Detailed Fault Isolation Test
Figure 104

R R 001B EFFECTIVITY: ALL



R Marker Beacon System Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B

MARKER BEACON SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

MB Test Set, TIC, T-30, or equivalent

Test set required only to perform functional test

2. Reference Procedure

24-00-00 Electrical Power System - Maintenance Practices

3. Adjustment/Test

NOTE: Satisfactory performance of the operational test (Paragraph 3B) ascertains that the receiver and light assemblies are operable. If the antenna, cable, and receiver sensitivity control are to be tested, or if more detailed testing of the receiver and light assemblies are to be performed, the procedures in the functional test (Paragraph 3C) should be accomplished.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, ensure the following circuit breakers are engaged:

AUDIO CONTROL - CAPT & FE (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

MARKER BEACON (D7)

(2) On FE/SO aft circuit breaker panel CB3, ensure the following circuit breakers are engaged:

AUDIO CONT - CAPT & FE (C16)

AUDIO CONT - F/O & OBS (C17)

AUDIO CONT - FLT INTPH AMPL (C18)

IND LT - PFCS/ADS/DH (G8)

(3) Turn on electrical power (Ref. 24-00-00).

(4) On FE/SO-ECS MONITOR panel, ensure AVIONIC AIR-FWD and MID LO FLO lights are out.

(5) On the Captains and First Officers marker beacon light assemblies, depress and release each indicator cap. Verify each indicator comes on when cap is depressed, and goes off when cap is released.

(6) On Captains and First Officers audio select panels located on pilots center console, depress and set MKR and SPKR controls to mid position.

(7) On SELCAL control panel located on pilots center console, set MARKER sensitivity switch to NORM.

(8) If detailed test is to be accomplished, go to Step 3C.

B. BITE

(1) Perform preparation, Paragraph 3A.

(2) Depress and hold SELF TEST pushbutton switch on marker beacon receiver front panel in FESC, rear rack, shelf No. 1. Two men are required, one in the FESC and one in the flight station. Verify that Captains and First Officers marker beacon lights sequence from blue, through amber and white in approximately 5 seconds accompanied with 400, 1300, and 3000 Hz tones heard through the flight station speakers. Verify that lights illuminate on marker beacon light assemblies and
R ADIs simultaneously.

(3) Release SELF-TEST pushbutton switch.

NOTE: SELF-TEST circuit requires 3-5 seconds to recycle after pushbutton release.

(4) If functional test will not be accomplished, perform test completion, Step 3D.

C. Functional Test

(1) NORM (low)-sensitivity test.

(a) Locate test set in flight station. Extend MB antenna.

NOTE: It may be necessary to operate test set just outside P1-P2 doors, or beneath marker beacon antenna.

(b) On test set, sequentially set and hold A (airways), O (outer) and M (middle) switches on, then release. Verify operation of marker beacon lights on Captain and First Officers marker beacon light assemblies (Ref. Table 401). Verify correct tone is heard through flight station speakers at each modulation test frequency. Verify that lights illuminate on marker beacon light assemblies and ADIs simultaneously. R R R

NOTE: Each of the switches is color keyed (white, blue, amber) and labelled A, O and M.

Marker Beacon Test
Table 401

FREQUENCY	LIGHT
400 Hz	OUTER (Blue)
1300 Hz	MIDDLE (Amber)
3000 Hz	AIRWAYS (White)

(2) HI (high) Sensitivity test.

(a) On test set, set and hold A switch on and verify airways (white) lights on each marker beacon light assembly is on and that 3000 Hz tone is heard in flight station speakers. Slowly push-in MB antenna until airways lights just go out and 3000 Hz tone is silenced.

(b) On SELCAL control panel, set MARKER switch to HI.

(c) Repeat Step C (1). Results shall be as specified.

D. Test Completion

(1) Turn off electrical power (Ref. 24-00-00).

(2) Remove test set if used.

MARKER BEACON RECEIVER - REMOVAL AND INSTALLATION

1. Reference Procedure

34-35-00 Marker Beacon System - Adjustment and Test Procedure

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag NO. 1 NAVIGATION MARKER BEACON (D7) circuit breaker.

(2) Open access door 112AB and enter forward electronics service center, zone 112. Locate marker beacon receiver in rear rack, shelf 1 (Ref. Fig. 401).

(3) Loosen knurled knob securing receiver to mount and disengage from hook on receiver front panel.

(4) Slide receiver forward in mount until disengaged from mount mating connector and guide pins.

(5) Remove receiver from mount.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Position receiver on mount and slide receiver back, mating receiver connector with mount connector and guide pins.

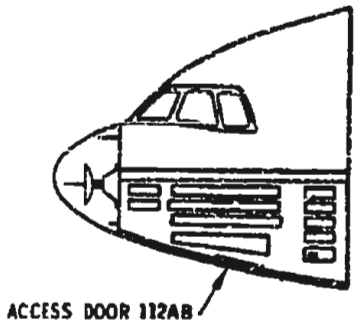
(3) Place mount clamp over receiver hook.

(4) Tighten knurled knob securing receiver to mount.

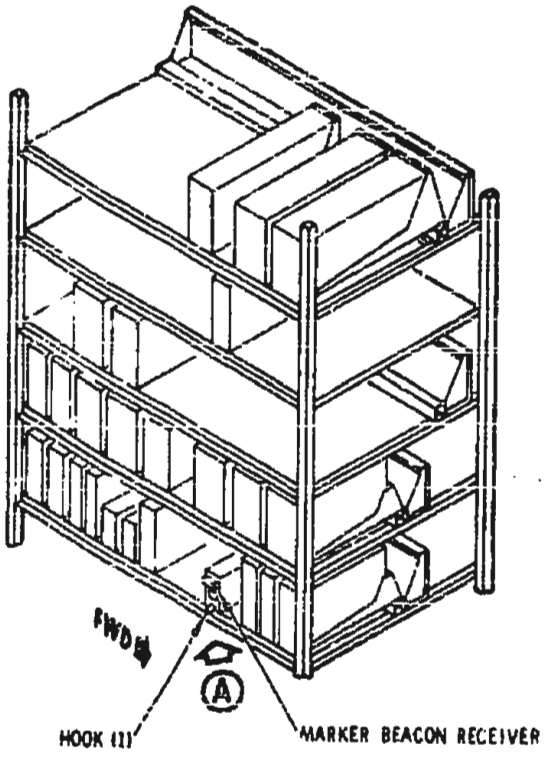
(5) Close and secure access door 112AB.

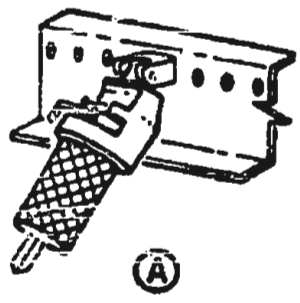
(6) Remove tag and close circuit breaker opened in Step A (1).

R (7) Perform marker beacon self-test procedure (Ref.
R 34-35-00, page 501).



FESC REAR RACK, SHELF NO. 1





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R Marker Beacon Receiver - Removal and Installation
R Figure 401

MARKER BEACON ANTENNA - REMOVAL AND INSTALLATION

1. Reference Procedure

34-35-00 Marker Beacon System - Adjustment and Test Procedure

51-25-00 Environmental Sealing

2. Equipment and Materials

Soft clean cloths

Plastic scraper

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279, Mfr. P/N PR1436G-B2, TW Stk Nbr 50-1188)

3. Removal/Installation

A. Removal

(1) Locate marker beacon antenna at bottom of fuselage, zone 124 (Ref. fig. 401).

(2) Remove screws securing antenna.

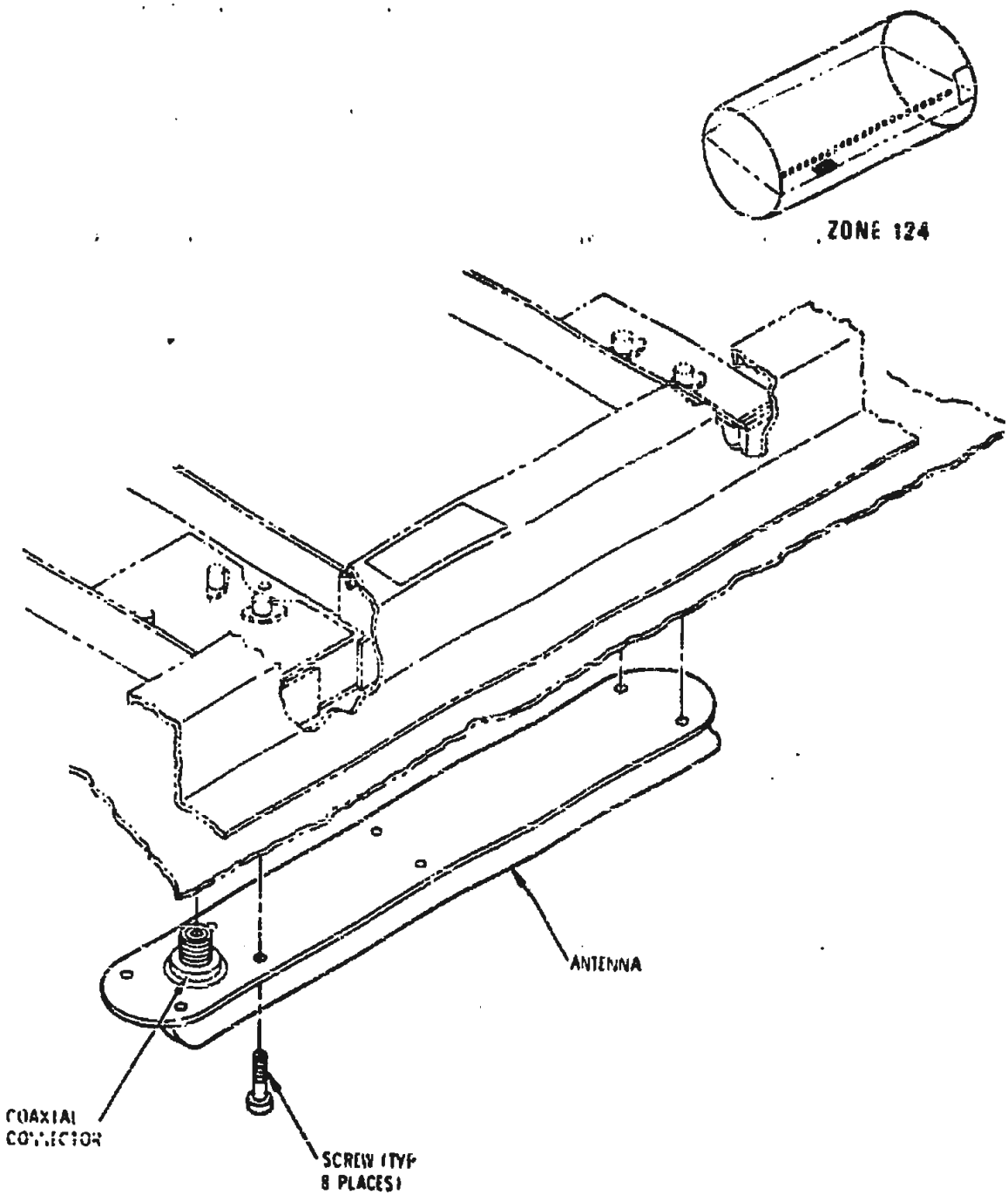
(3) Lower antenna with coaxial cable attached.

(4) Support antenna while disconnecting coaxial connector from antenna base.

(5) Remove antenna from aircraft.

(6) Cap coaxial connector.

WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.



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CR Marker Beacon Antenna - Removal and Installation
CR Figure 401

WARNING: KEEP MEK AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

(7) Using plastic scraper, remove sealant from fuselage structure. Using soft clean cloth moistened with methyl-ethyl-keytone solvent, wipe fuselage structure clean.

B. Installation

C (1) Remove cap and connect coaxial connector threads onto
C antenna receptacle. Spray LPS-3 onto remaining threads
C then secure the connector.

WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

C (2) Spray fuselage and antenna mating surfaces with LPS-3
C compound.

(3) Raise antenna with attached coaxial cable into mounting position.

(4) Secure antenna with screws.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(5) Apply a continuous sealant fillet between antenna mounting plate and fuselage using Environmental Sealant, LAC Spec C-40-1279 or equivalent (Ref. 51-25-00).

R (6) Perform marker beacon system functional test procedure (Ref. 34-35-00).

CR

MARKER BEACON ANTENNA - ADJUSTMENT/TEST

CR 1. Antenna System - Voltage Standing Wave Ratio (VSWR) Test

CR A. General

CR (1) This procedure is to be followed when abnormal CR performance and/or trouble shooting procedures indicate CR the marker antenna system is malfunctioning.

CR (2) Marker beacon receiver power must be available to CR perform the tests inasmuch as the R&R 90214 tester is CR powered by it. The MARKER BEACON circuit breaker must CR be pulled prior to removal of installation of the CR receiver to prevent burning of its connector pins.

CR (3) The tests are to be conducted where no surrounding CR objects will affect the marker beacon antenna on the CR aircraft.

CR B. Test Equipment Required

CR (1) R&R 90214 marker antenna tester.

CR (2) R&R 90189 cable analyzer kit.

CR C. Test Antenna System

CR NOTE: To use R&R 90214 tester, insert it into receiver CR rack, press power switch to ON, adjust meter to SET CR with the switch in FORWARD position then select CR REFLECTED and read VSWR.

CR (1) Pull the MARKER BEACON circuit breaker.

CR (2) Remove the marker receiver from its rack.

CR (3) Insert the tester into the receiver rack. Reset MARKER CR BEACON circuit breaker.

CR (4) Activate the tester and determine if the VSWR is 2:1 or CR less. If so, no further action is required except to CR reinstall the receiver and perform an operational test CR of the marker beacon system using a ramp test unit in CR accordance with chapter/section 34-35-00, marker beacon CR system adjustment/test.

CR (5) If the reading is NOT 2:1 or less, disconnect the CR marker antenna from its transmission line and connect a

CR bird 50 ohm load (or other 50 ohm terminator) in place
CR of the antenna. Recheck the VSWR.

CR (6) If the VSWR is now 2:1 or less, replace the defective
CR antenna, recheck the VSWR to insure the new antenna
CR meets specifications, reinstall the receiver and
CR perform an operational test of the system using a ramp
CR test unit in accordance with chapter/section 34-35-00,
CR marker beacon system adjustment/test.

CR (7) If the VSWR is NOT 2:1 or less, connect an R&R 90189
CR cable fault analyzer to pin A1 of the receiver
CR connector. Determine which portion of transmission
CR line or which connector is defective. Make corrections
CR as required, recheck the VSWR using the R&R 90214
CR tester and, when satisfactory, connect the antenna to
CR the transmission line and install the antenna. (For
CR Fault Analyzer Tests, refer to chapter/section
CR 23-03-00).

CR (8) Check the VSWR of the antenna and its transmission
CR line. If the VSWR is 2:1 or less, reinstall the
CR receiver and perform an operational test of the system
CR using a ramp test unit in accordance with chapter
CR 34-35-00, marker beacon system adjustment/test. If the
CR VSWR is NOT 2:1 or less, replace the antenna, recheck
CR the VSWR to insure the new antenna meets
CR specifications, reinstall the receiver and perform an
CR operational test of system using a ramp test unit in
CR accordance with chapter/section 34-35-00, marker beacon
CR system adjustment/test.

MARKER BEACON LIGHT ASSEMBLY - REMOVAL AND INSTALLATION

1. Reference Procedure

34-35-00 Marker Beacon System - Adjustment and Test Procedure

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION MARKER BEACON (D7). R

(2) Locate light assembly on Captains instrument panel, zone 211, or First Officers instrument panel, zone 212, (Ref. Fig. 401).

(3) Loosen quarter-turn fasteners securing instrument panel containing marker beacon light assembly to be removed, and slide panel out.

(4) Disconnect and tag wires on terminals at rear of light assembly. Replace each terminal screw after wire removal.

(5) Remove bolts securing light assembly to instrument panel.

(6) Gently pull light assembly forward ensuring that terminals clear panel cutouts.

B. Installation

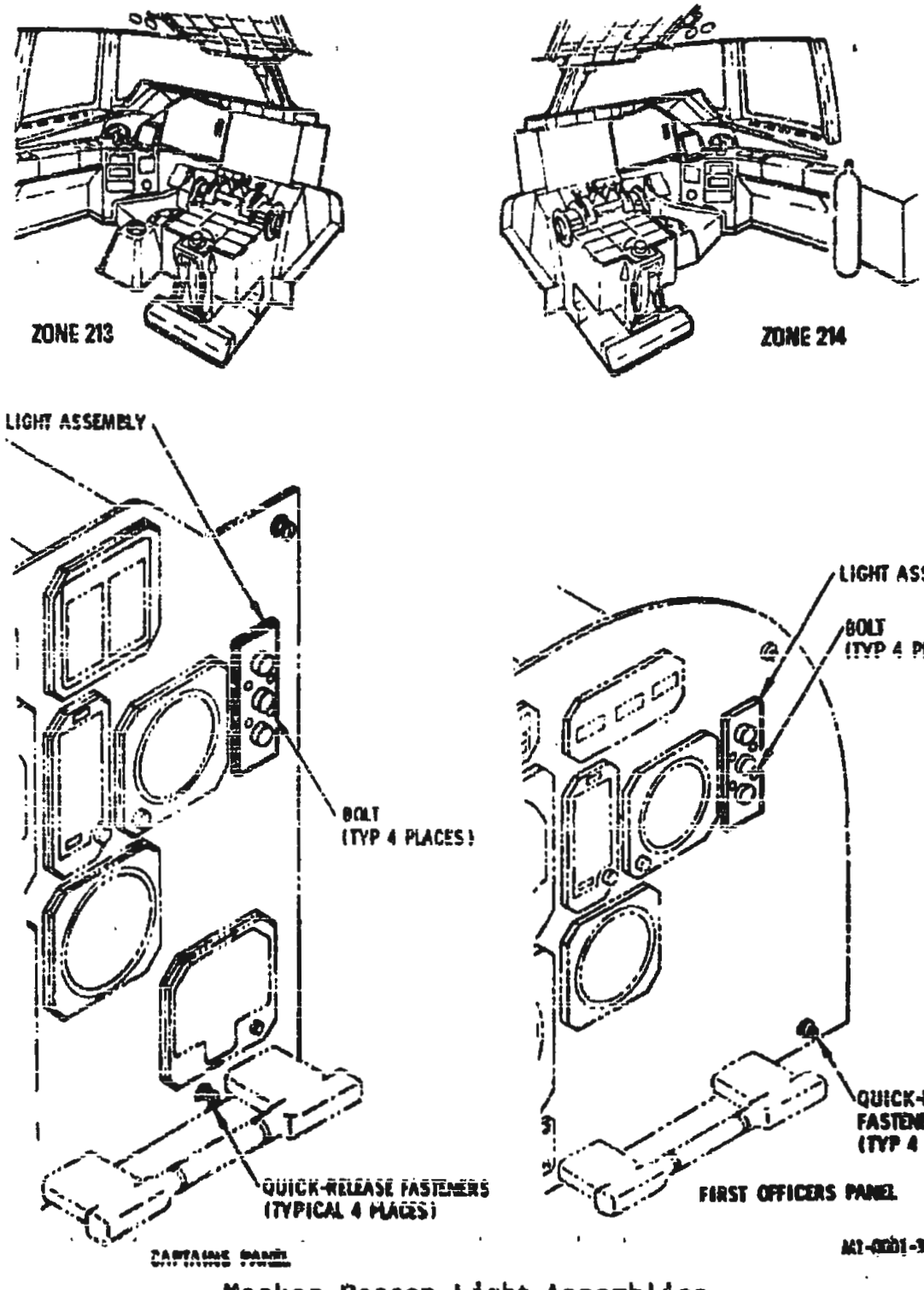
(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Insert light assembly through instrument panel cutout.

(3) Secure light assembly to instrument panel with bolts.

(4) Connect wires to terminals at rear of light assembly, and remove wire tags.

(5) Push instrument panel into position and secure with quarter-turn fasteners.



R Marker Beacon Light Assemblies
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

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(6) Remove tag and close circuit breaker opened in Step A(1).

(7) Perform marker beacon system adjustment and test procedure (Ref. 34-35-00).

INDEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION

1. General

The independent position determining systems are that portion of the navigation system which provides information to determine position, and is mainly independent of ground installations. The independent position determining systems and components are:

On aircraft with INS installed,
Inertial Navigation System (INS) (Ref. 34-43-00):

- Inertial Navigation Unit (INU)
- Control Display Unit (CDU)
- Mode Selector Unit (MSU)
- Battery Unit (BU)
- INS-Radio Transfer Unit

Weather Radar System (WX) (Ref. 34-44-00):

- Receiver - Transmitter (R/T)
- Weather radar antenna
- Weather radar indicator
- Weather radar control panel

Ground Proximity Warning System (GPWS) (Ref. 34-45-00):

- Ground proximity warning computer
- Warning speaker

R On aircraft with INS,
R the inertial navigation system interfaces with the following
R systems:

R Autoflight, attitude, ADC, weather radar, and the flight
R recorder.

The weather radar system interfaces with the attitude reference system (Ref. 34-21-00).

The ground proximity warning system interfaces with the following systems: air data computer, radio altimeter, instrument landing system, landing gear and flap systems.

INERTIAL NAVIGATION SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)

A. The inertial navigation system (INS) automatically determines the navigation and attitude data of the airplane to keep the airplane on a predetermined course. The INS requries no navigational aids external to the airplane, and barometric altitude and true airspeed from the central air data computer (CADC) are its only inputs from onboard navigational equipment. The INS can perform navigation without these CADC inputs with only slightly degraded performance. The navigation data is displayed on flight instruments, allowing the flight crew to fly the airplane to the INS reference. The data is also supplied to the autopilot systems (Chapter 22), allowing the airplane to be automatically flown along the computed course if the autopilot/flight director is operated in the INS NAV mode with either channel A or B engaged.

B. Three separate Delco Carousel IV INS systems are installed in the airplane. Each INS consists of a mode selector unit (MSU), a control/display unit (CDU), a navigation unit (NU), and a battery unit (BU). Aircraft interface is provided by two INS Interface Units (ITU) and one RNAV accessory unit. (See Fig. 1.)

(1) The control/display units for INS No. 1, 2 and 3 are located on the forward control stand electronic panel.

(2) The mode selector units for all three systems are located on the pilot's overhead panel.

(3) The three navigation units are located on the forward rack in the forward electronics service center.

(4) The battery units for all three systems are located in a rack (between the forward and center racks) in the forward electronic service center, zone 112.

(5) The two INS Interface units and RNAV accessory unit are located on the left hand, aft electronics rack, shelf 4 in the forward electronics service center.

C. The INS continuously computes horizontal navigation data and senses airplane attitude displacements in pitch, roll, and yaw from a local-horizontal reference. Output signals from the INS are used to steer the airplane over a computed course to a preselected destination, to maintain the airplane and the weather radar display at a level attitude,

and to display navigation data and airplane attitude on navigation and flight instruments. No. 1 & 2 INS furnish a numerical display of its navigation data and operating status on the horizontal situation indicators (HSI).

D. The INS navigation unit contains a gyro stabilized gimbal assembly which senses all changes in airplane attitude and acceleration. Attitude stabilization signals are produced for airplane movement about its pitch, roll, and yaw axes. Instruments in the gimbal assembly sense all vertical and horizontal accelerations (velocity changes). The velocity change signals, central air data computer signals, and manually inserted position data are used by a digital computer in the navigation unit. The digital computer uses the input signals to continuously solve navigation equations, to produce output signals for automatic steering along the desired track, and for display of the computed data.

E. The INS is characterized by the following features:

(1) Automatic self-alignment and calibration are accomplished each time the INS is turned on.

(2) Provides continuous cyclic ground alignment.

(3) Uses (but does not require) inputs from external navigation aids.

(4) Monitors its own performace and furnishes warning indications when output signals and displayed data are unreliable.

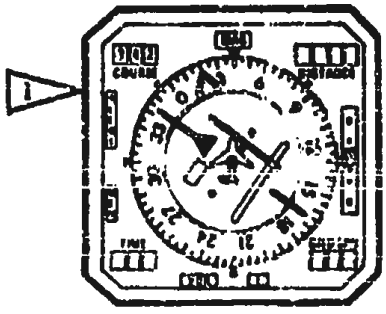
(5) Insertion of present position, waypoint, and destination data is easily accomplished by using a keyboard.

(6) Operates accurately within any latitude and longitude encountered in flight, including polar flights.

(7) Indicating lights and displays can be replaced while INS is operating without hazard to equipment or personnel.

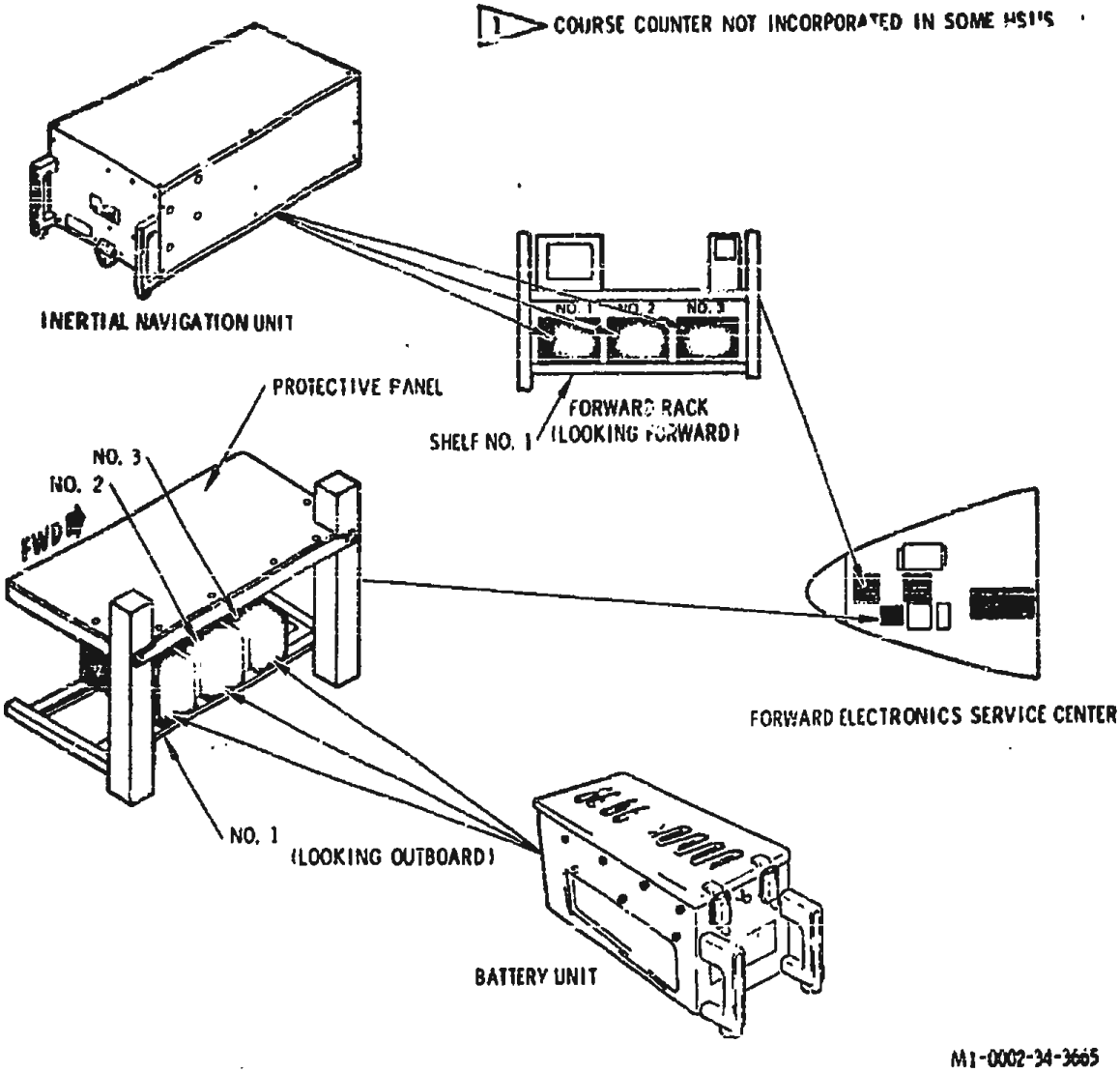
(8) Can be used to produce only attitude (roll, pitch, and yaw) stabilization signals if navigation and/or steering signals become unreliable.

(9) Although barometric altitude and true airspeed from the central air data computer are inputs to the INS, loss of these inputs will not seriously affect INS operation.



HORIZONTAL SITUATION INDICATOR

1 COURSE COUNTER NOT INCORPORATED IN SOME HSI'S



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Inertial Navigation System
Figure 1 (Sheet 1)

EFFECTIVITY:INS EQUIPPED AIRCRAFT

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(10) INS performance can be improved during flight by making a position fix when an accurate present position reference is available.

(11) The INS can be used to simulate airplane attitude movements as an aid in avionic system interface testing. This is accomplished with a gimbal slew feature that provides the capability to tilt the INS platform about both its pitch and roll axes.

F. Principal airplane systems and indicators that are connected to the INS (Fig. 2) are listed below:

(1) AC Power System (24-22-00)

(2) Central Air Data Computer (CADC) (34-14-00)

(3) Autoflight Systems (Chapter 22)

(4) Weather Radar (34-44-00)

(5) Magnetic Heading Reference System (MHRS) (34-22-00)

(6) Attitude Director Indicator (ADI)

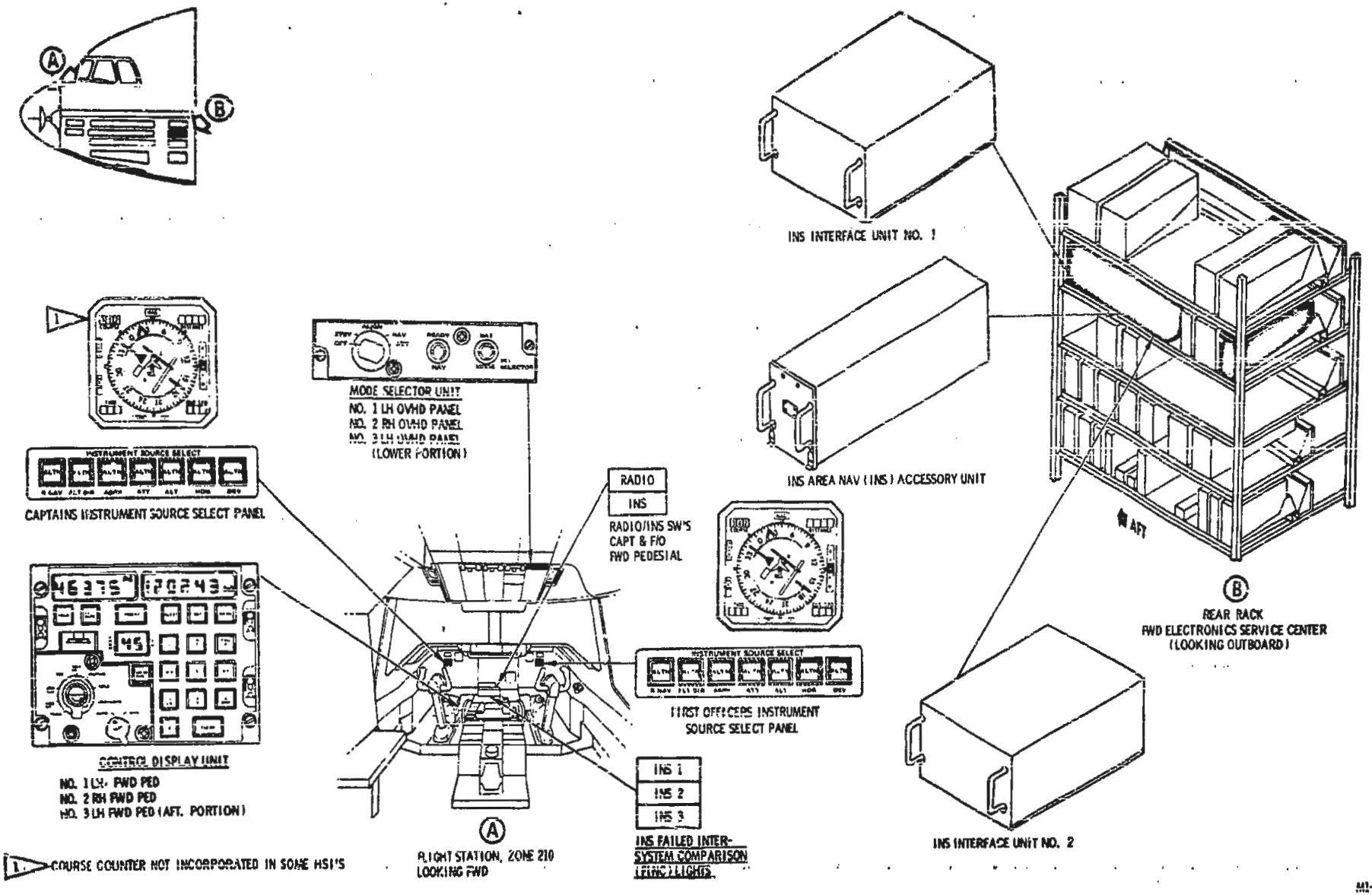
(7) Horizontal Situation Indicator (HSI)

(8) Optional navigation data displays capable of using synchro, analog, or digital input signals.

G. Power, true airspeed signals, and barometric altitude signals are the only electrical inputs required by the INS.

(1) Three types of 400 Hz ac power are required from the airplane electrical system. These are 115 volts, 26 volts, and variable 0 to 5 volts (Fig. 3). The 0 to 5 volts is used for panel lighting in the mode selector unit and for panel and keyboard lighting in the control/display unit. The 26 volts is used in the navigation unit for excitation of synchro signal outputs. The 115 volts supplies all other requirements during normal operation.

(2) The true airspeed input signals to the INS from the central air data computer are used for determination of wind speed and wind direction. The barometric altitude from the central air data computer is used for damping the integrating loop which computes altitude. Should the barometric altitude signal become unreliable, the INS automatically uses a simulated altitude profile, which is selected on the basis of ground speed, in place of the barometric altitude.



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Inertial Navigation System
Figure 1 (Sheet 2)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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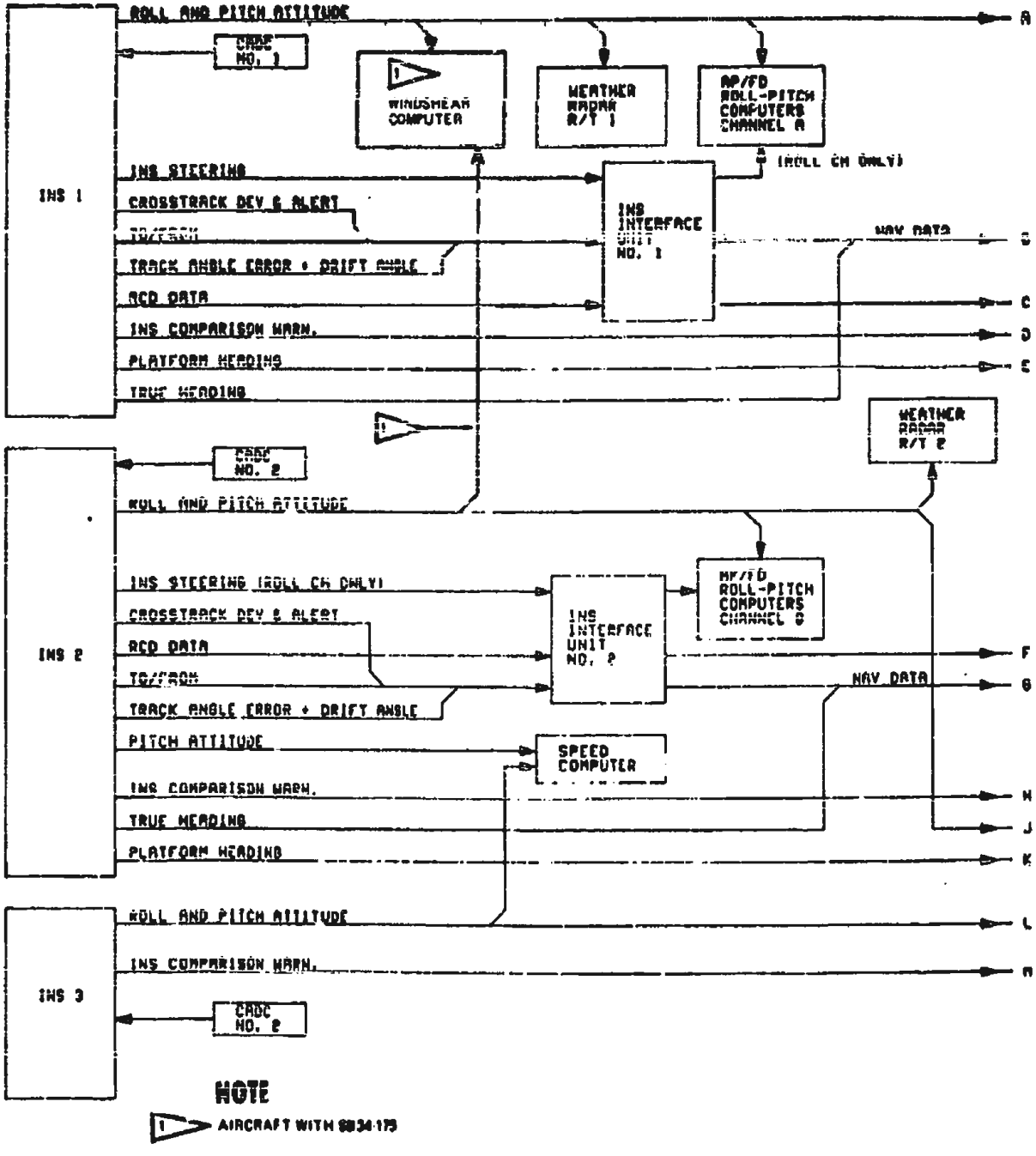

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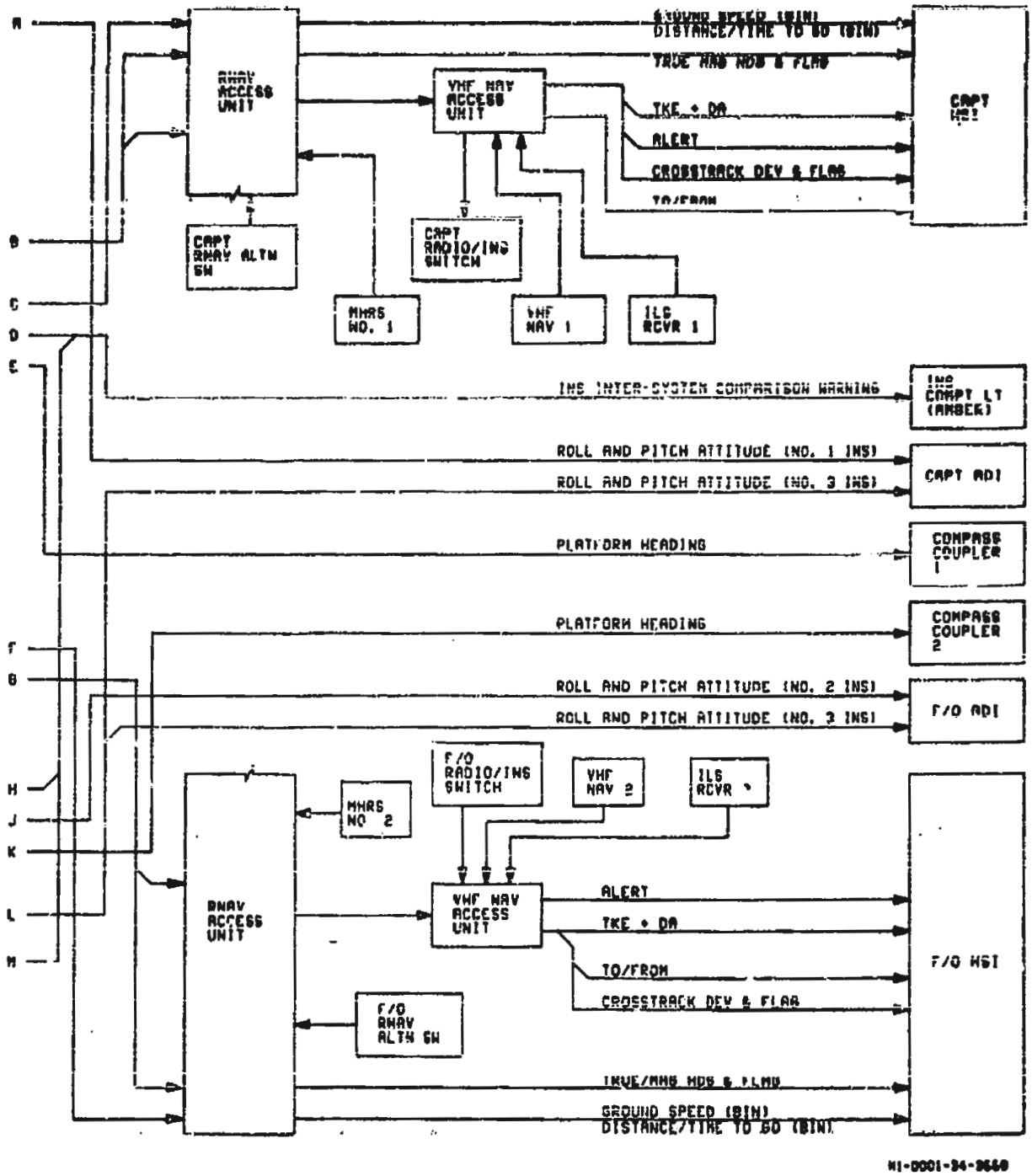
iNS Interface Block Diagram
Figure 2 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT



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INS Interface Block Diagram
Figure 2 (Sheet 2)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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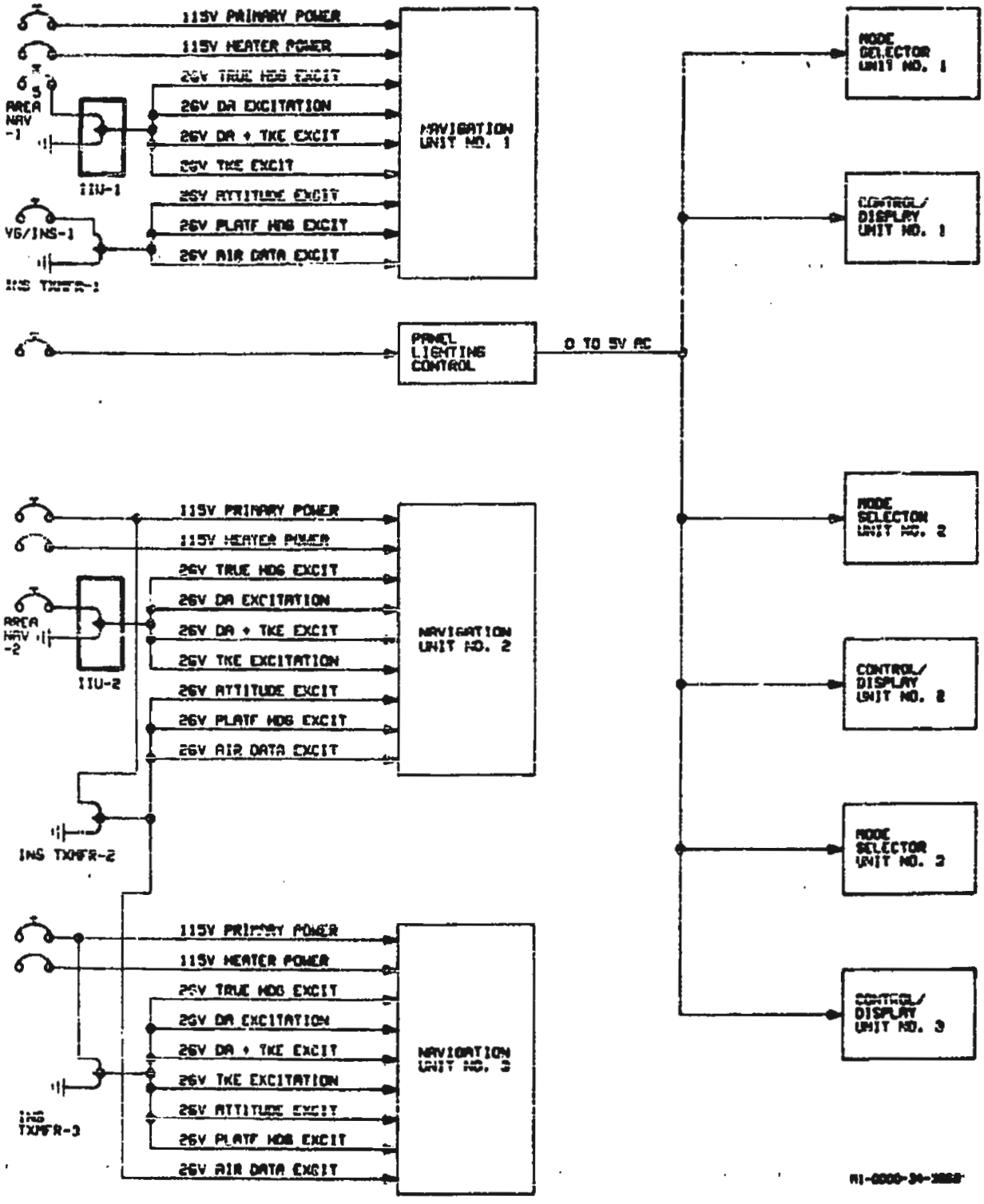

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INS Power Inputs
Figure 3

EFFECTIVITY:INS EQUIPPED AIRCRAFT

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H. The navigation information relationships determined by the inertial navigation system are best described by referring to Figure 4. These relationships are displayed in digital form on the control/display units and in analog form on the pilots' flight instruments.

(1) True heading (HDG) is the angle between the airplane centerline and true north.

(2) True airspeed (TAS) is the airspeed of the airplane with respect to the surrounding air.

(3) Wind speed (WS) is the magnitude of the wind velocity vector in knots.

(4) Wind direction angle (WD) is the angle between true north and the wind velocity vector.

(5) Ground track angle (TK) is the angle between true north and an imaginary line on the earth's surface connecting successive position points over which the airplane has flown (ground track).

(6) Ground speed (GS) is the velocity with which the airplane is moving over the earth's surface.

(7) Drift angle (DA) is the angle between the airplane's true heading and ground track.

(8) Desired track angle (DSRTK) is the angle between true north and an imaginary line on the ground connecting successive position points desired to overfly; this line being the great circle segment that lies between two successive waypoints.

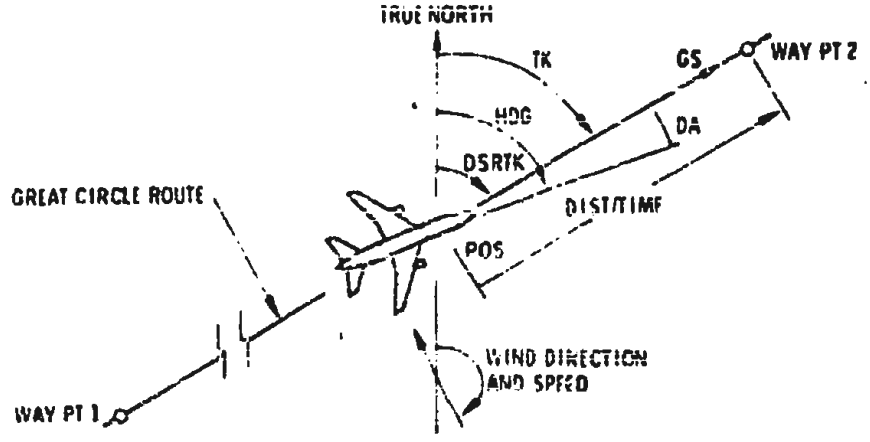
(9) Present position (POS) is the actual latitude and longitude position of the airplane.

(10) Cross track distance (XTK) is the shortest distance between the airplane's present position and the desired track.

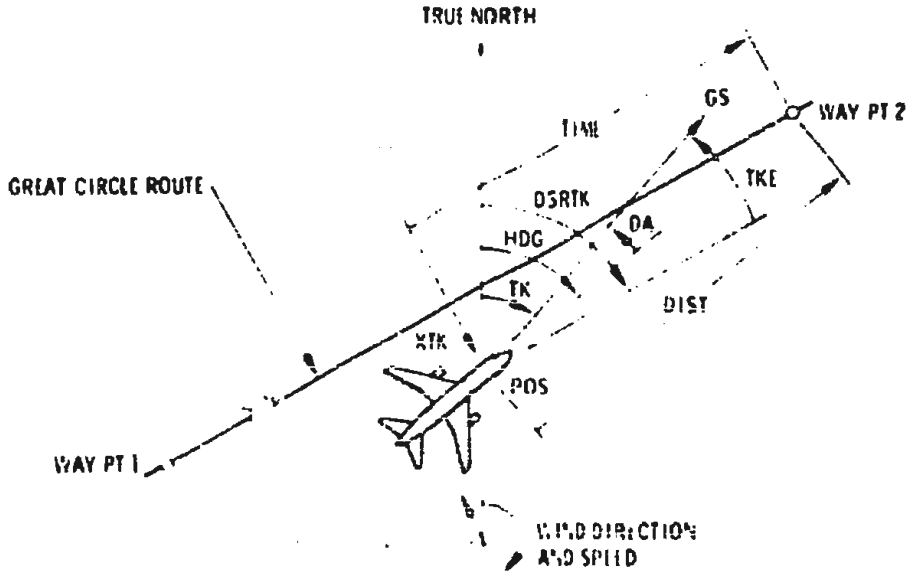
(11) Track angle error (TKE) is the angle between the airplane's actual ground track and the desired ground track.

(12) Distance (DIST) is the great circle distance between the present position of the aircraft and the next waypoint or destination.

I. A gimbal slew procedure provides the capability to slew the INS platform about the pitch and roll axes. The purpose of



ON TRACK



OFF TRACK

TK - TRACK ANGLE
GS - GROUND SPEED
HDG - TRUE HEADING
DA - DRIFT ANGLE
XTK - CROSS TRACK DISTANCE
TKE - TRACK ANGLE ERROR
POS - PRESENT POSITION
WAY PT - WAYPOINT
DIST - DISTANCE-TO-GO
TIME - TIME-TO-GO
WIND - WIND SPEED/ DIRECTION
DSRTK - DESIRED TRACK ANGLE

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C
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Inertial Navigation Relationships
Figure 4

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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the slewing is to simulate airplane attitude changes while monitoring the avionics instruments to observe the resulting changes in attitude displays. Since the INS platform attitude angles are simultaneously displayed on the Control/Display Unit and also routed to airplane interfaces, gimbal slew can be used to verify proper aircraft interface wiring, to calibrate the weather radar antenna and the HSI and ADI displays, or to verify line maintenance activities such as replacement of ADI's, HSI's, weather radar antennas and autopilot flight director pitch and roll computers.

(1) The gimbal slew capability was added by INS computer Program TWA 31J.

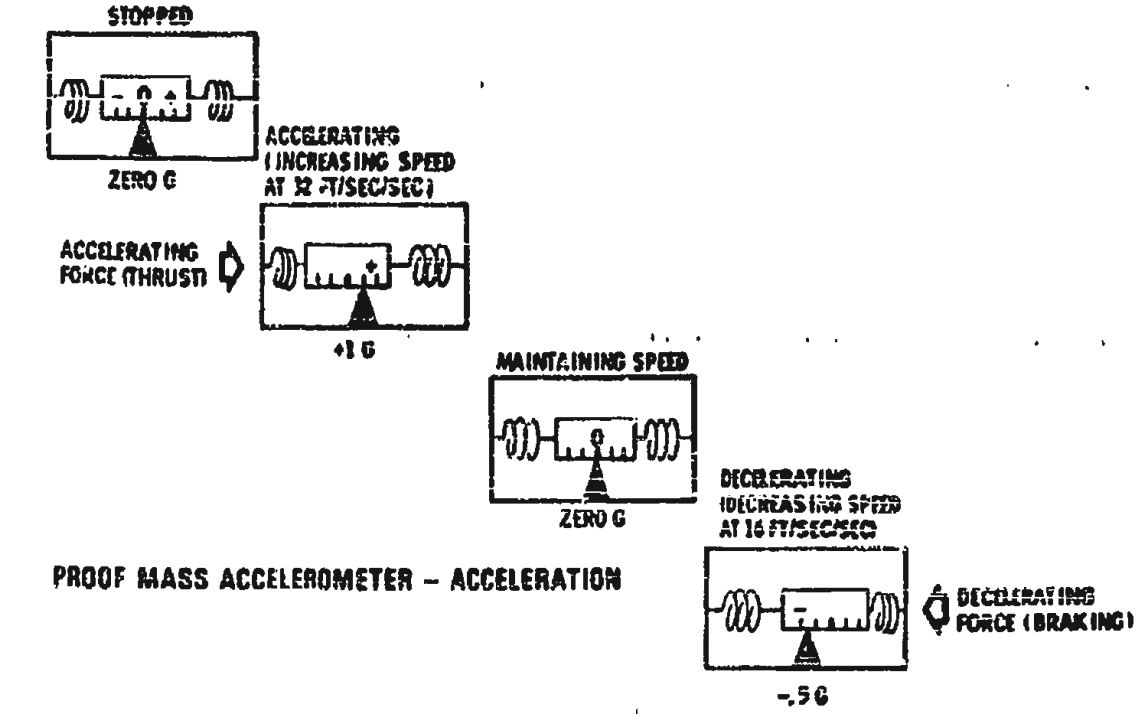
2. Basic INS Principles

A. The basic components of any inertial navigation system include accelerometers, gyros, inertial platforms, and computers. An understanding of INS operation is predicated upon an understanding of these basic devices.

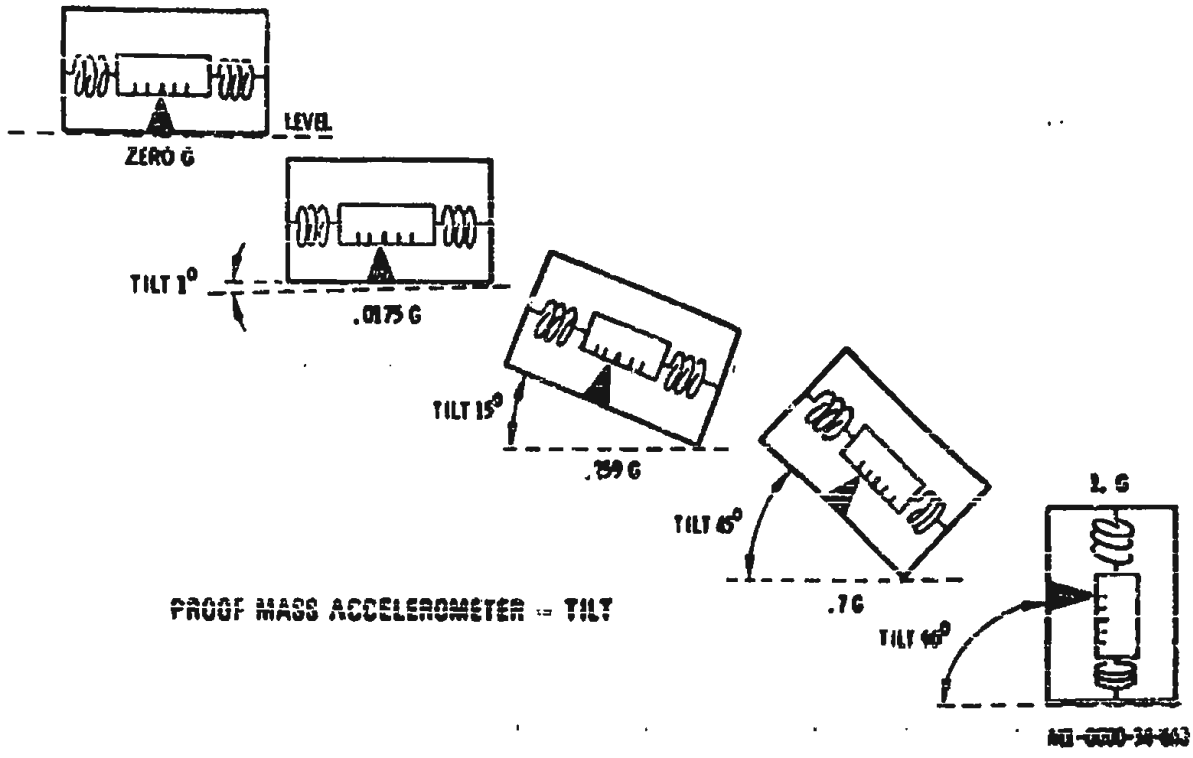
B. Accelerometers

(1) An essential component of any inertial navigation system is the accelerometer which sense changes in airplane velocity. In its simplest form, an accelerometer consists of a small weight (proof mass) suspended between two springs (Fig. 5). Acceleration sensed in a horizontal direction causes the mass to compress one of the supporting springs and stretch the other. The compressive force and the equal but opposite tensile force are proportional to the degree of airplane acceleration along the accelerometer sense axis. Spring displacement is directly proportional to the accelerating or decelerating forces which can be read on a scale calibrated in gravity (g) units.

(2) As long as the accelerometer remains with its sense axis perpendicular to the local vertical axis of the earth's gravitational field, only accelerations due to airplane horizontal velocity changes are sensed. Therefore, a simple accelerometer must be kept level at all times so that it will not misinterpret the force of gravity as an acceleration. An accelerometer at rest can be used, however, to sense the direction of gravity as a vertical acceleration. For example, an accelerometer senses components of gravitational acceleration as its sense axis is tilted toward the local vertical axis. In this instance it functions as a level detector.



PROOF MASS ACCELEROMETER – ACCELERATION



PROOF MASS ACCELEROMETER – TILT

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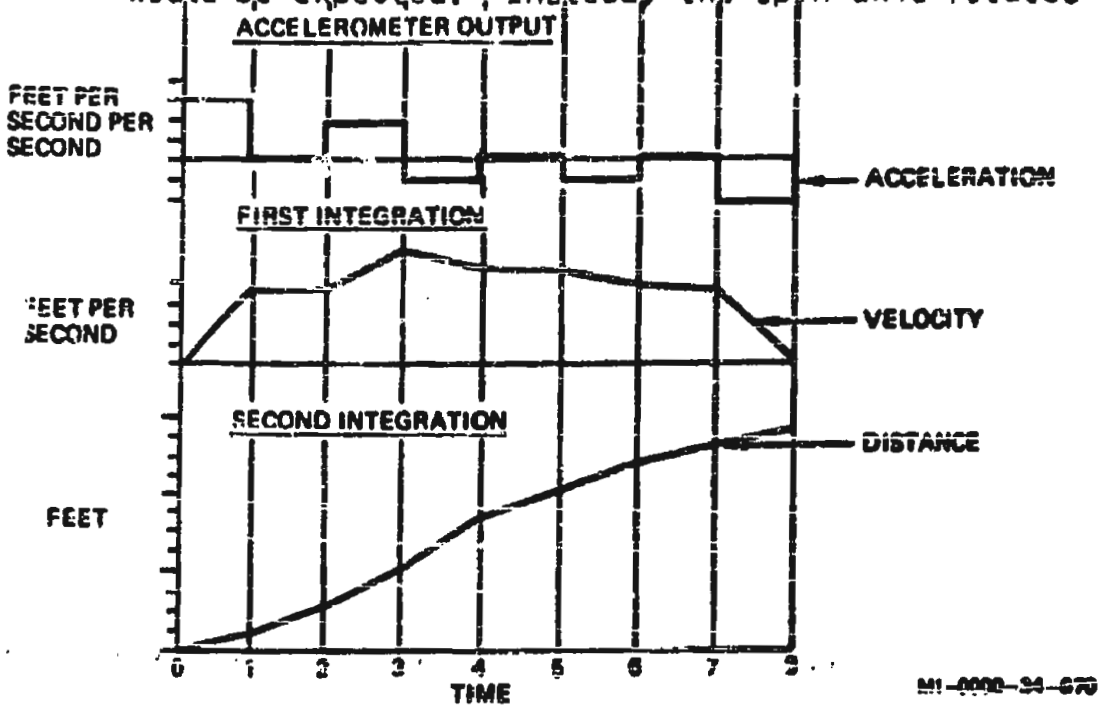
C Simple Proof Mass Accelerometer
Figure 5

(3) Mathematically, it is possible to derive functions of velocity and distance from an original acceleration function through a process of successive integration (Fig. 6). In this manner, pulse signals representing airplane acceleration are electronically integrated to obtain airplane velocity. The airplane velocity is then integrated to obtain distance traveled.

C. Gyros (Fig. 7)

(1) Another essential component of an inertial navigation system is the gyro. In its simple form the gyro is an accurately balanced spinning flywheel or rotor (Fig. 7). The rotor spins about a central or spin axis (SA) which passes through its center of gravity. The rotor shaft and its bearings are suspended within a gimbal. The gimbal is free to rotate about an axis which is perpendicular to the rotor spin axis called the gyro output axis (OA). The gyro operates on the principle of gyroscopic inertia which is the characteristic of a rotating mass to resist any forces which tend to change the direction of its spin axis. When a torque is applied around an axis perpendicular to both the SA and OA axis, namely the input axis (IA), the spin axis will tip but not in the direction of the torquing force as would be expected. Instead, the spin axis rotates



Accelerometer Output Integration
Figure 6

around the output axis at right angles to the applied torque. This is known as induced gyroscopic precession.

(2) Gyroscopic inertia fixes the spin axis of the gyro in space. However, because the earth rotates in space, the space-oriented gyro appears to rotate with respect to an earth-bound observer. This apparent rotation of the gyro spin axis is called apparent gyroscopic precession. Except for two special cases, this makes the gyro unsuitable for use as an earth-fixed reference unless the gyro is deliberately torqued to rotate at a rate proportional to the earth's rotation rate (earth rate). When torqued in this manner, the spin axis appears stationary and the gyro is effectively slaved to the earth's coordinate system.

(3) A second form of apparent precession is due to vehicle motion over the curved surface of the earth. Consider the gyro to be in an airplane flying north along a meridian from the equator to the pole. If the gyro spin axis were oriented horizontal and parallel with the meridian when at the equator, the gyro spin axis (being space stabilized) would appear to rotate to a vertical orientation relative to earth as the airplane flies north. Consequently, in order to use the gyro as an earth-reference device in a moving airplane, it must be torqued to compensate for north-south airplane motion over the earth's surface in addition to earth rate.

(4) Similarly, when flying east or west and starting with the gyro spin axis oriented in the horizontal and aligned east-west, the spin axis will appear to tilt due to travel east or west. This tilt is in addition to that caused by earth rate. Therefore, a gyro precessing torque is also necessary to maintain the earth reference orientation during east-west travel.

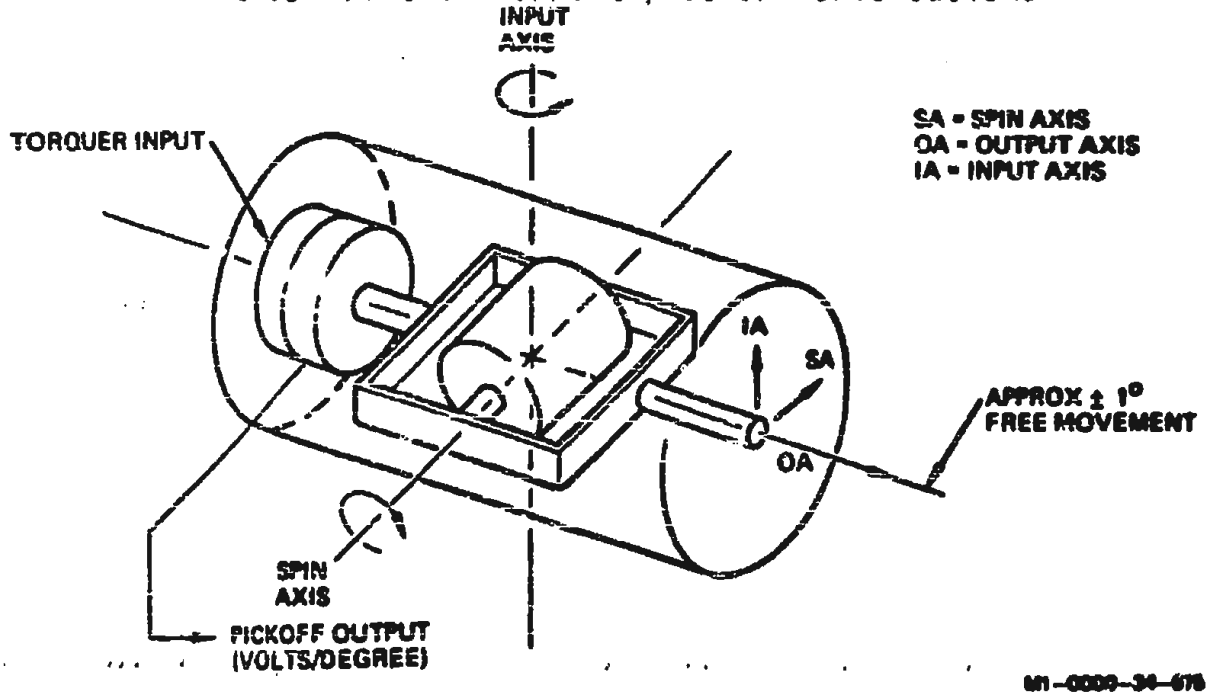
(5) The total gyro torquing signals necessary to slave a moving gyro to an earth-related coordinate system consist of an earth rate component, a vehicle velocity component, and a gyro drift rate compensation component.

D. Inertial Platform

(1) An airplane moving in three dimensions over the earth's surface has 6 degrees of freedom, three translational (north-south, east-west, and up and down) and three rotational (roll, pitch, and azimuth). Actual airplane motion is a changing combination of all 6 degrees of

motion. Sensing of this motion is accomplished by a gyro stabilized frame of reference known as an inertial platform. The platform consists of a tilt table suspended in a servo-driven gimbal system. The gimbal system isolates the acceleration sensing devices from rotational motion of the airplane and maintains the platform parallel to the earth's surface regardless of airplane motion or earth rotation. The gimbal system effectively decouples the inertial platform from the airframe and provides all-attitude freedom of motion.

(2) Platform stabilization is achieved by use of three single-degree of freedom gyros mounted on the platform in the all-attitude gimbal system. The gyros are mounted with their sense (input) axes mutually perpendicular. Any minute tilt or rotation of the platform produces an input torque about the sense axis of one or more of the gyros. This causes induced gyroscopic precession which causes the gyro gimbal to rotate about the gyro output axis and generate an output signal from the gyro pickoff which is representative of the angular displacement of the gimbal. This signal is amplified and used to drive the platform gimbal torquer through a corresponding angle or rotation to maintain the gyro output at a null, and thus maintain correct platform orientation.



Rate Integrating Gyro
Figure 7

(3) Stabilization of the inertial platform allows a fixed coordinate system to be established within which airplane accelerations can be measured. This is accomplished by two accelerometers, mounted on the stable platform with their sense axes mutually perpendicular and aligned with reference axes on the platform. The accelerometers sense airplane translational motion and are maintained parallel to the earth's surface. A third accelerometer is mounted on the platform to sense vertical acceleration.

E. Computer

(1) The inertial navigation problem uses continuously changing navigation parameters and system error correction factors to obtain a high degree of accuracy in the attitude and heading computations. For this reason a computer is used as the information processing center for the inertial navigation system. The computer:

(a) solves mechanization equations associated with great circle navigation

(b) supplies control information to the inertial platform to keep it earth referenced

(c) supplies digital information to various INS and interface components in order to display system status and navigation parameters

(d) monitors its own operation and that of other INS components

(e) supplies guidance signals to the autopilot to steer the airplane along a great circle path

(f) solves mechanization equations associated with calibration and updating performance parameters of the INS components

(g) tests for and isolates INS malfunctions

3. Mode Selector Unit (Fig. 8)

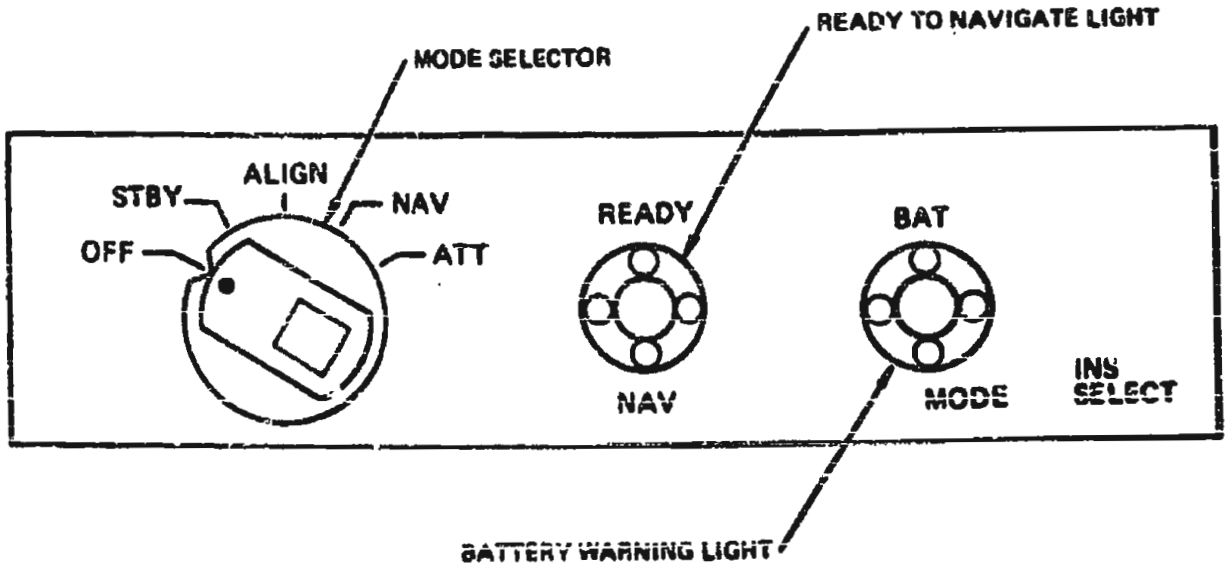
A. The mode selector unit (MSU) contains a mode selector and two indicating lamps mounted on an illuminated panel. The mode selector has five positions: OFF, STBY, ALIGN, NAV, and ATT. These positions are used to control operating modes of the INS. The two indicating lamps indicate operating status only when the mode selector is in the ALIGN

position. The BAT lamp (red) will illuminate if the battery unit is not charged enough to sustain INS operation for a brief test period during INS alignment. If this lamp illuminates, the INS will shut down automatically. The READY NAV lamp (green) illuminates when the INS is automatically aligned to the desired accuracy, indicating that the mode selector can be advanced to the NAV position. After the READY NAV lamp has lighted and the mode selector is advance to the NAV position, the READY NAV lamp will remain lighted.

B. During the gimbal slew procedure, the mode selector is set to the ALIGN position.

4. Control/Display Unit (Fig. 9)

A. The CDU contains a power supply, logic circuits, controls, and indicators. The controls and indicators are used to insert information into the DCU and to display DCU output data. The logic circuits transform inserted data into BCD digital data and BCD digital data into illuminated indications consisting of indicating lamps and numerical displays. The CDU also contains indicating lamps which indicate INS operating status.



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INS Mode Selector Unit
Figure 8

B. The left-hand and right-hand data displays are composed of lamps which indicate numbers, decimal points, degree symbols, left and right directions, and latitude and longitude directions. The data displayed by these displays is selected by the data selector and test switch. Illumination of the decimal points and degree symbols is controlled by the position of the data selector. Illumination of all other lamps in the data displays is controlled by the DCU except when loading data. The keyboard and CLEAR key control the data displays while data is being loaded. Once the INSERT key is pressed, loaded data from the displays is inserted into the DCU and the DCU then resumes control of the data displays.

C. The keyboard consists of 10 keys which are used to load present position latitude and longitude, waypoint/destination latitude and longitude, desired performance index, and waypoint changes into the displays. Keyboard illumination intensity is controlled by a cabin lighting control.

D. The CLEAR key is used to clear the data displays during data loading when erroneous data is inadvertently loaded. The lamp in the CLEAR key is controlled by the DCU.

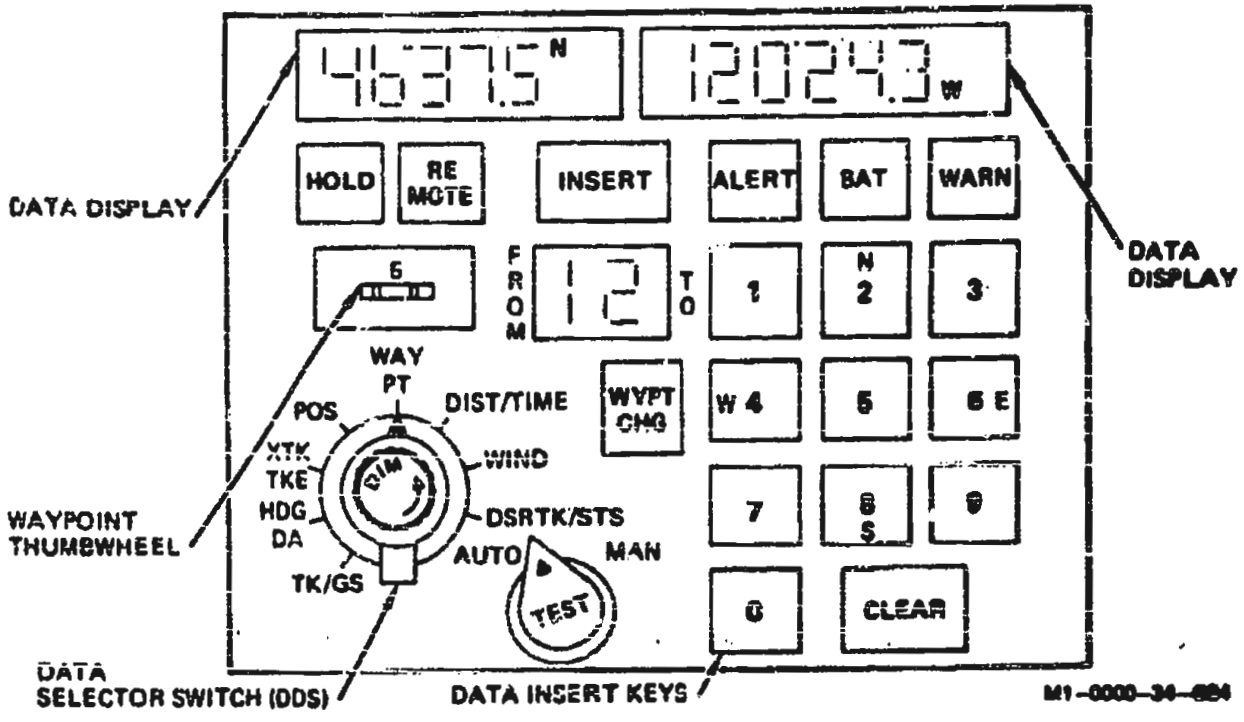
E. The INSERT key is used to insert loaded data into the DCU. The loaded data is displayed in the data displays for verification but is not inserted into the DCU until the INSERT key is pressed. The lamp in the INSERT key is controlled by the DCU. The lamp illuminates when the mode selector is set to STBY to indicate that present position data must be loaded, and goes out when present position latitude and longitude are inserted. The lamp also illuminates when the INS is downmoded from NAV to ALIGN and goes out when present position data is loaded or when the mode selector is returned to NAV.

F. The data selector has eight positions for selecting data to be displayed in the data displays. Three of these positions also allow data to be loaded into the data displays and then inserted into the computer memory.

(1) The data selector is set to POS for insertion of present position into the DCU during preflight, for insertion of a fix point position when making a position fix, or for making a position update after landing. Present position of the airplane is displayed on the data displays after the initial insertion when the data selector is set to POS. Latitude is loaded and displayed in the left-hand data display and longitude is loaded and displayed in the right-hand data display. Both data displays indicate degrees and

minutes to the nearest tenth of a minute. Latitude is displayed from 0 to 90 degrees north or south and longitude is displayed from 0 to 180 degrees east of west. During the gimbal slew procedure, the data selector is set to POS in order to obtain a readout of pitch or rol. on the data displays.

(2) The WAYPT position of the data selector, in conjunction with the waypoint selector, allows waypoint and destination positions to be inserted into the DCU. The data displays will display the inserted latitude and longitude of the waypoint/destination when the data selector is set to WAYPT and the waypoint selector is properly positioned. The waypoint selector numeral is repeated on the FROM side of the FROM-TO display when the data selector is positioned to WAYPT. The "TO" side of the FROM-TO display is blanked when data selector is positioned to WAYPT. The WAYPT positions of the data selector is also used in conjunction with the waypoint selector, to display unfixed inertial present position and to allow eradication of a position fix from the computer. Latitude and longitude are loaded and displayed in the same units and accuracies as when the data selector is set to POS.



INS Control Display Unit
Figure 9

(3) Present track angle and ground speed are indicated in the data displays when the mode selector is at NAV and the data selector is set to TK/GS. Present track angle is displayed from 0 to 359.9 degrees in the left-hand data display to the nearest tenth of a degree with respect to true north. Ground speed is displayed from 0 to 2400 knots in the right-hand data display to the nearest knot. The displayed value of ground speed is always actual, but actual true heading is displayed in place of present track angle when ground speed is below 75 knots. The INS indicates a malfunction if the displayed ground speed is 910 knots greater.

(4) Airplane heading and drift angle are indicated in the data displays when the mode selector is at NAV and the data selector is set to HDG/DA. Heading is displayed from 0 to 359.9 degrees in the left-hand data display to the nearest tenth of a degree with respect to true north. Drift Angle is displayed from 0 to 180 degrees right or left of the airplane heading in the right-hand data display to the nearest degree. The displayed value of heading is always actual, but the displayed drift angle is 0 degrees when ground speed is below 75 knots. The INS will indicate a malfunction if the displayed drift angle is 45 degrees or greater.

(5) Cross track distance and track angle error are indicated in the data displays when the mode selector is at NAV and the data selector is set to XTK/TKE. Cross track distance is displayed from 0 to 999.9 nautical miles right or left of the desired track in the left-hand data display to the nearest tenth of a nautical mile. Track angle error is displayed from 0 to 180 degrees right or left of the desired track angle in the right-hand data display to the nearest degree. The displayed value of cross track distance is always actual, but desired track angle minus heading is displayed in place of track angle error when ground speed is below 75 knots.

(6) Distance and time to the next waypoint (displayed on the TO side of the FROM-TO display) are indicated in the data displays when the mode selector is at NAV and the data selector is set to DIS/TIME. Distance is displayed from 0 to 9999 nautical miles in left-hand data display to the nearest nautical mile. Time is displayed from 0 to 999.9 minutes in the right-hand data display to the nearest tenth of a minute. The displayed value of distance is always actual or 9999 nautical miles, whichever is less. The displayed value of time is 999.9 minutes when ground speed is below 10 knots.

(7) Wind direction and speed are indicated in the data displays when mode selector is at NAV, true airspeed is greater than 150 knots and the data selector is at NAV, true airspeed is greater than 150 knots and the data selector is set to WIND. Wind direction is displayed from 0 to 359 degrees in the left-hand data display to the nearest degree. Wind speed is displayed from 0 to 605 knots in the right-hand data display to the nearest knot. Both wind direction and wind speed are indicated at 0 when true airspeed is less than 170 knots and ground speed is less than 85 knots.

(8) Desired track angle and system status are indicated in the data displays when the data selector switch is set to DSRTK/STS. Desired track angle is displayed from 0 to 359 degrees in the left-hand display when the system in in the NAV mode. System status is displayed in the right-hand display when the system is in the STBY, ALIGN, or NAV modes. The first digit from the left is the NAV mode indicator (0 not in NAV, 1 in NAV), the 2nd and 3rd digits display action codes (01-05) and malfunction codes (10-63) only when a malfunction has occurred, the 4th digit is blank, the 5th digit displays alignment mode status (9-6) and actual performance index (5-0), and the 6th digit displays the desired performance index (5). At system turn on, the alignment mode status number is 9. This number will reduce during the alignment mode of operation indicating the actual status of automatic alignment. When the display reduces from 9 to 5 INS alignment is complete. In the NAV mode, the actual PI stops reducing when it reaches the desired PI number. The single digit desired performance index number is displayed to the right of the mode status/actual performance index number. The desired performance index displays a 5 at turn on.

(9) The INS is placed in a gimbal slew mode when a special gimbal slew test connector is installed in J28 on the front of the Navigation Unit and the Mode selector is set to ALIGN. With the data selector switch set to POS, pitch displacement is displayed from 0 to 71 degrees in the left display. N represents pitchup and S represents pitchdown. Roll displacement is displayed from 0 to 71 degrees in the right display. W represents left roll and E represents right roll.

G. The AUTO-MAN switch is normally left at the AUTO position. This allows automatic navigation leg switching during flight. If the MAN position is used, the INS will not switch to the next navigation leg, but will continue to furnish and display steering signals to maintain the desired

track for the completed navigation leg. The ALERT light will flash after passing the waypoint at the end of the navigation leg. The flashing or steady ALERT light will be inhibited below 250 knots ground speed.

(1) During the gimbal slew procedure, the AUTO-MAN switch is set to AUTO for pitch slew and to MAN for roll slew.

H. The waypoint selector, in conjunction with the WAYPT position of the data selector, allows waypoint and destination positions to be inserted into the computer in the proper sequence. During flight, the automatic navigation leg switching by the computer is accomplished in sequence according to the inserted positions from 1 to 9 unless a course change is inserted. The previously inserted latitude and longitude for a waypoint/destination is indicated in the data displays when the waypoint selector is set to the waypoint number (1 thru 9) and the data selector is set to WAYPT. The position coordinates displayed when the waypoint thumbwheel selector is set to 0 are normally those of the original departure point inserted at time of alignment. The displayed coordinates can be changed, however, if a course change is made during flight (0 in FROM display) or an inflight fix is made. The coordinates are changed each time one of the two actions-preflight alignment or course change is accomplished. The original departure point, position coordinates can be displayed even after either of these actions by pressing the HOLD button with waypoint "0" selected.

I. The FROM-TO display indicates two origin/waypoint/destination numbers describing the navigation leg for which automatic navigation data is being computed. Waypoint numbers 0 1 are always displayed at INS turn on. As a flight progresses through waypoints, the FROM-TO display automatically changes to indicates the next navigation leg when a waypoint is reached. The normal automatic sequence is 0 1, 1 2, 2 3, etc. The waypoint sequence can be interrupted at any time by loading different numbers into the FROM-TO display and inserting them into the computer to cause a course change. The number 0 represents a point on one of the navigation legs at which a course change was initiated.

J. The WYPT CHG key is used in conjunction with the keyboard and INSERT key to make a course change. The WYPT CHG key and INSERT key illuminate when pressed the first time. This allows different waypoint numbers to be loaded into the FROM-TO display using the keyboard. Insertion of the different numbers into the DCU using the INSERT key causes the WYPT CHG and INSERT key lights to go out. Both key lights will also go out when the CLEAR key is pressed.

(1) The WYPT CHG key can also be used to display distance and time (based on present ground speed) between any two geographic locations. When the WYPT CHG key is pressed, the displayed distance and time on the CDU are the distance and time between the two waypoints in the FROM-TO display. Any waypoint numbers, including 0 for present position, can be loaded in the FROM-TO display, but not inserted into the DCU, to display distance and time between the two locations. Automatic steering with respect to the originally displayed FROM-TO waypoints is not affected by this procedure. Pressing the CLEAR key restores the displays to normal indications.

K. The HOLD key is used in conjunction with other CDU controls to stop displayed present position from changing, to perform a position update, to display inertial present position, to display recorded malfunction codes, to display program identification on DSRTK selection, to display wind-on-nose on WIND selection and to display departure point position on WYPT selection with waypoint 1-9 selected. The HOLD key lights when pressed the first time and goes out when pressed the second time or when inserted data is accepted by the DCU.

(1) During the gimbal slew procedure, the HOLD key is used to stop all slewing operations. Slewing can occur only when the HOLD key light is off.

L. The REMOTE key illuminates amber when pressed and allows simultaneous loading and insertion of waypoint and destination data into more than one INS by using only one CDU. The REMOTE key must be pressed on all participating INS to achieve this simultaneous loading. The remote operation is disabled when the REMOTE keys are again pressed and the key light goes out. The REMOTE key can also be used in conjunctions with the HOLD key to freeze present position data on more than one INS at he same instant during flight and to insert a present position update during flight.

(1) The REMOTE key has an entirely different function during the gimbal slew procedure. In this mode, the REMOTE key is used to establish the direction of slew. The REMOTE key must be illuminated for roll left, pitchdown or counterclockwise azimuth slew. The REMOTE key must be off for roll right, pitchup or for clockwise azimuth slew.

M. The ALERT lamp illuminates amber 2 minutes before reaching a waypoint or destination during flight. The light goes out when the INS automatically switches to the next navigation

C leg. With the AUTO/MAN switch selected to MAN, the ALERT
C lamp will flash after TO waypoint passage.

C N. The BAT lamp illuminates amber when the INS is operating on
C battery power.

C O. The WARN lamp lights red when the INS self-testing circuits
C detect an out-of-tolerance condition. Illumination of the
C WARN lamp can be caused by a continuous or intermittent
C condition. Intermittent out-of-tolerance conditions
C detected by the DCU light the WARN lamp until it is reset by
C the TEST switch. If the WARN lamp is lighted by a
C continuous condition which does not degrade attitude
C operation and the WARN lamp goes out when the mode selector
C is set to ATT.

C (1) During the gimbal slew procedure, the WARN lamp lights
C red when the gimbal slew test connector is inserted in
C J28 on the front of the INU. The WARN lamp remains lit
C until the gimbal slew test connector is removed and all
C malfunction codes have been cleared by pressing the
C TEST button.

C P. The TEST switch, common to the AUTO-MAN switch, is used to
C test all indicating lamps and displays and associated
C circuits and to reset the malfunction warning circuits in
C the DCU. The TEST switch is also used in conjunction with
C other controls to display numerical codes indicating the
C operating mode of the DCU, malfunctions in the system, and
C recommended action to be taken in response to illumination
C of the WARN lamp.

CR Q. The DIM knob on the data selector is used to vary light
C intensity of the data displays, the FROM-TO display, the
C ALERT lamp, and the HOLD, REMOTE, INSERT, and WYPT CHG keys.
C The DIM knob does not, however, control the BAT or WARN
C lamps. The knob is detented to prevent inadvertent dimming
C of the lamps.

C 5. Navigation Unit

C A. The navigation unit (NU) is a temperature controlled unit
C which produces all INS output signals. Each unit is
C supported on three precision rack-mounted pins which slide
C into bushings in the NU case. Two bushings are in the rear
C and one in the front of the case assembly. The unit slides
C into the rack over a gasket which seals the aircraft forced
C air cooling system to the bottom of the case assembly.
C Exhaust cabin air is routed through heat exchangers in the
C NU for cooling during operation. The NU contains an
C. inertial reference unit (IRU), a digital computer unit

(DCU), and an inertial reference unit electronics section (IRUE).

B. The azimuth synchro signal is a direct output to the compass system. This signal represents a constant compass direction but it does not represent a specific compass angle. The pitch and roll signals to the attitude director indicator are direct synchro signal outputs.

C. The electronics section of the NU includes assemblies which control and convert input power, produce precision frequency signals, charge the battery unit, control temperatures, buffer pitch and roll synchro output signals, amplify stabilization and accelerometer loop signals, and control moding and warning flag signals. The pitch and roll synchro isgnals are buffered in the gimbal electronics and transmitted to the autopilot and weather radar for stabilization.

D. Warning flag logic circuits in the electronics section receive signals from the IRU, DCU, and other assemblies in the electronics section. The logic circuits control warning flags in the attitude director indicator and the horizontal situation indicator. The logic circuits also produce a master warning signal for the WARN lamp on the control display unit.

E. The electronics section furnishes power, timing and control signals to the IRU and DCU. Horizontal and vertical acceleration signals are processed in the electronics section and transmitted to the DCU.

F. The DCU of the navigation unit consists of assemblies which make up a digital computer with input/output circuits to perform necessary conversion between analog and digital signals. The latitude and longitude of the flight origin, waypoints, and destination are inserted into the DCU using the control/display unit keyboard. True airspeed and barometric altitude are signal inputs to the DCU from the central air data computer. The latitude and longitude inputs, air data computer inputs, constants contained in the DCU memory, and inputs from the IRU and electronics are used to continuously solve navigation equations and produce signals for control and display during the NAV mode of operation. The DCU also performs self-tests and comparisons between its output data and the output data of the other INS computers and produces warning signals if tolerances are exceeded.

G. The DCU output signals are the gyro positions, sent to the electronics section control so that the IRU will be properly oriented with respect to the earth as present position is

changed. Mode control, alert, and warning flag signal outputs from the DCU are also transmitted to the electronics section.

H. The DCU computes a roll steering signal which is transmitted to the autopilot to maintain the airplane on the desired track during automatic navigation. Navigation data signals are transmitted from the DCU to the horizontal situation indicator (HSI) and the control/display unit for visual displays and to other INS DCU's for comparison and remote loading.

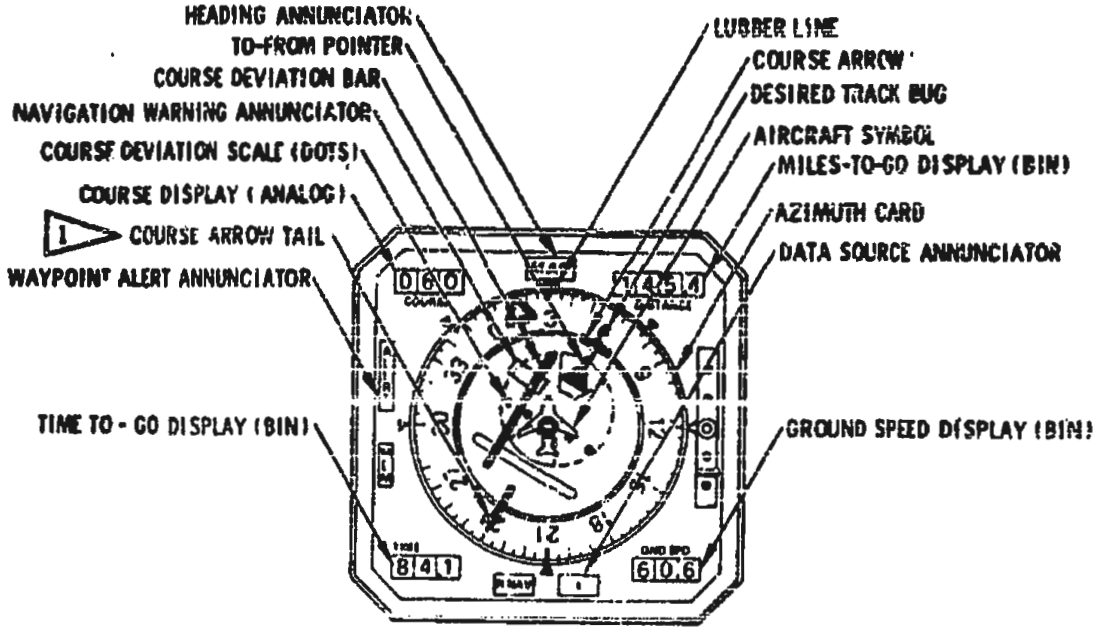
6. Battery Unit

A. The battery unit (BU) provides auxiliary power to initiate INS turn on and to supply essential power to maintain INS operation when the 115-volt input power is interrupted or drops below the required voltage. The battery unit contains 19 nickel-cadmium cells which are connected in series to furnish 24 volts dc. A 20-ampere circuit breaker on the front of the battery unit protects it from excessive current flow if a short circuit develops. Power from the battery unit is used momentarily to close a relay which turns on the INS, and also is used for a 10-second battery test period during automatic INS alignment. Battery unit power is connected to the INS power circuits so that it will sustain INS operation in any operating mode if primary power fails. The battery unit will sustain INS operation for periods of up to 15 minutes.

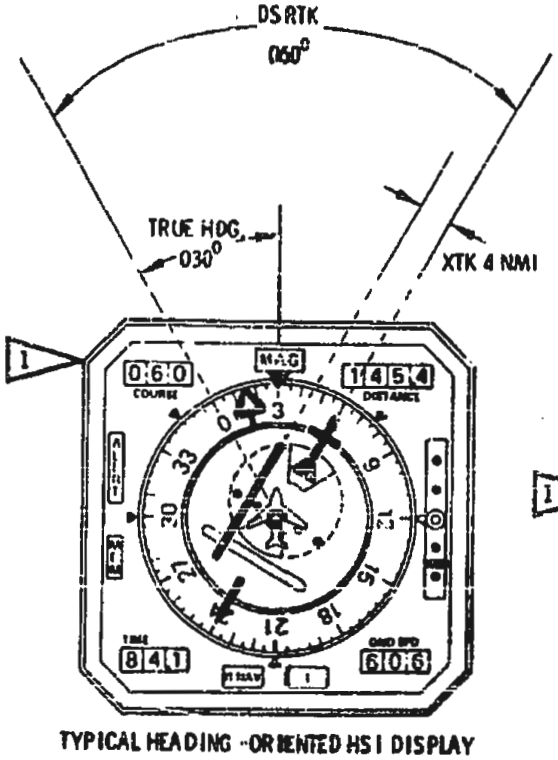
B. The INS will automatically transfer to battery power if ground power is removed from the airplane with the INS turned on. In order to protect the INS batteries from inadvertent discharge, the INS mode selectors should be switched to OFF when unattended.

7. Horizontal Situation Indicator (Fig. 10)

A. Two horizontal situation indicators (HSI) are installed in the airplane, one on each pilots' instrument panel. Each indicator is a composite instrument used primarily to display airplane heading with respect to true north, or magnetic north as determined by its mode of operation. The HSI also displays information from conventional sources such as the VOR/ILS and magnetic heading reference systems as well as from the inertial navigation system dependent on RADIO/INS switch positions.



HSI CONTROLS AND INDICATORS



NOTE

1 COURSE COUNTER NOT INCORPORATED IN SOME HSI'S

TYPICAL HEADING-ORIENTED HSI DISPLAY

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CR Horizontal Situation Indicator
CR Figure 10

EFFECTIVITY:INS EQUIPPED AIRCRAFT

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B. Both HSI's receive INS navigation information from INS No. 1 or No. 2 as selected from their respective RNAV/ALTN switches.

C. The horizontal situation indicators, operating in a true heading-oriented INS mode, display airplane true heading, desired track, drift angle, distance to the next waypoint, and ground speed (fig. 10). Binary signals representing distance, ground speed, and time are decoded in separate digital displays. The preselect heading bug indicates magnetic heading as selected on the autopilot/flight director mode select panel.

(1) True heading is displayed by the azimuth card relative to the lubber line.

(2) Ground speed information is displayed by the GND SPD numerical display.

(3) Time to go is displayed to the TIME numerical display.

(4) Cross track deviation is displayed by the course deviation bar relative to the course deviation scale.

(5) Desired track information is displayed by the course arrow read against the azimuth card and on the COURSE numerical display.

(6) Miles-to-go is displayed by the DISTANCE numerical display.

D. The HSI provides annunciators to indicate operating status.

(1) A data source annunciator is located in the lower portion of the instrument. The data source annunciator displays the type of system supplying the HSI [Radio or R NAV (INS)] and the number of that particular system (1 or 2).

(2) A heading information annunciator is located above the lubber line at the top of the indicator. A MAG annunciator appears when magnetic heading is displayed and a TRUE annunciator appears when true heading is displayed.

(3) An ALERT annunciator is located in the middle left portion of the instrument face. When the INS signifies that the airplane is within 2 minutes of its selected waypoint or destination, the ALERT annunciator illuminates.

E. The HSI furnishes warning flags to annunciate heading and navigation failures.

(1) A HDG flag appears in event of loss of the heading valid signal from the input data source, loss of heading servo power, or excessive heading servo error signal.

(2) A NAV failure warning annunciator, located adjacent to the course deviation bar, appears when navigation data is missing or invalid.

(3) The miles-to-go, time-to-go, and ground speed numerical display are each covered if INS input signals are lost or digital data flag becomes invalid.

8. Attitude Director Indicator (Fig. 11)

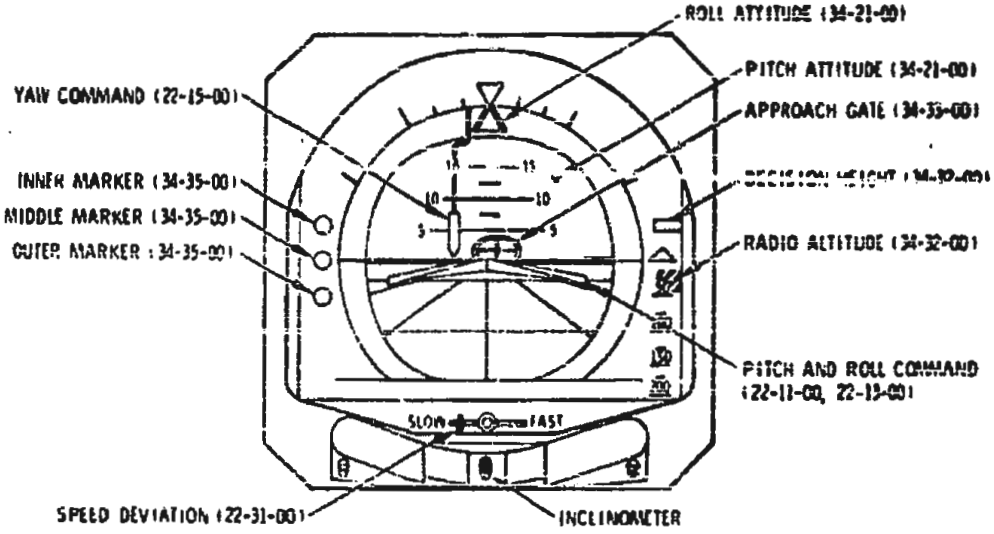
A. Two attitude director indicators (ADI) are installed in the airplane, one on each pilot's instrument panel. The indicators are used primarily to display airplane attitude. Each is, however, a composite instrument which accepts and displays glide slope and localizer deviation, marker beacon information, radio altitude, speed commands, and flight director commands from other navigation systems.

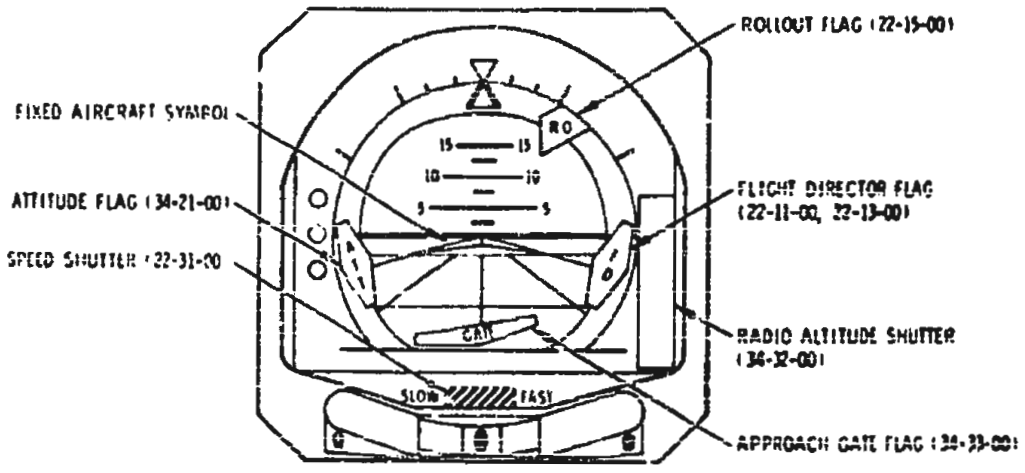
B. The captain's ADI receives pitch and roll attitude information from INS No. 1 or 3 as selected by the ATTN ALTN switch on the captain's flight instrument panel. The first officer's ADI receives pitch and roll information from INS No. 2 or 3 as selected by the ATT ALTN switch on the first officer's flight instrument panel.

C. Airplane attitude is indicated by a dc torque motor-drive tape representing the horizon and moving relative to a fixed airplane symbol near the center of the instrument face (Fig. 11). The tape rotates in pitch and roll to correspond to the airplane attitude. In event of power loss to the indicator, an attitude (ATT) warning flag appears to indicate an invalid attitude indication.

9. Flight Instrument Switching

A. The horizontal situation indicators and attitude director indicators are multipurpose instruments used to display flight information from several different systems. Because of this, INS information is transferred to these instruments through a flight instrument switching network.





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C
C Attitude Director Indicator
Figure 11

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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B. The various instrument switching relays are located in the RNAV Accessory Unit (INS Navigation) located on the LH Aft Electronic Rack, Shelf 4. INS attitude switching is accomplished in each attitude director indicator.

C. The portion of the network involving the INS consists of a captain's and F/O's RADIO/INS switch, captain's and F/O's RNAV ALTN source select switches and appropriate accessory units. The attitude switching is arranged so that the captain can select system No. 1 or No. 3 and the first officer can select system No. 2 or No. 3. The compass stabilization switching is discussed in 34-22-00, Magnetic Heading Reference System.

(1) The captain's RADIO/INS switch controls the captain's RNAV Accessory Unit relays which allow the captain's HSI to display heading information from either the radio navigation and magnetic heading reference systems, or the INS. The first officer's RADIO/INS switch relays function in a similar manner for the first officer's HSI.

(2) The captain's and first officer's RNAV ALTN switches allow each HSI to display information from either INS 1 or INS 2.

(3) In normal operation, attitude information from INS No. 1 and INS No. 2 is displayed on the captain's and first officer's ADI. If the captain's ALTN ATT switchlight is pressed, a relay is energized in the captain's ADI. The relay contacts connect attitude information from INS No. 3 to drive the captain's ADI. When the first officer's ALTN ATT switchlight is pressed, operation is identical to that of the captain's ALTN ATT switchlight except INS No. 3 attitude information is displayed on the first officer's ADI.

(4) INS No. 3 can be selected by either pilot simultaneously.

CR 10. INS Cooling System

A. It is extremely important that inertial navigation units have an adequate cooling air supply since overheating will result in failure of the navigation units.

B. To ensure that the INS system will always have a supply of cooling air, an INS cooling air fan is installed in the auxilliary cooling air exhaust duct. This fan operates independantly from the forward avionics fan and provides the

INS with a cooling air supply in the event the forward avionics fan fails or high ambient temperature exists.

C. The Flight Engineer's Panel, ECS Monitor Panel incorporates an INS COOLING ON/LO FLO light just to the right of the CARGO HEAT-AFT COLD/HOT light. The INS COOLING"ON" nomenclature will illuminate when the INS cooling fan is operating and will remain on until the switchlight is depressed and the INS cooling air temperature sensor detects normal temperatures. The INS COOLING "LO FLO" nomenclature will illuminate whenever the INS cooling air temperature sensor detects above normal temperatures. Simultaneously with "LO FLO" nomenclature illumination, the INS cooling fan will run and the LO FLO nomenclature will extinguish. When the "ON" and "LO FLO" nomenclatures are both illuminated, the INS cooling air temperature is above normal with the INS cooling fan operating and INS operation may be limited. The normal equipment cooling system (Forward Avionics FAN) is sufficient to properly cool the INS under normal conditions.

11. Functional Description - Intersystem Position Comparison System (See Fig. 12)

A. This system is incorporated as part of the CDU program and utilizes inserted position coordinates during ALIGN mode and inertially-determined coordinates during NAV mode. These coordinates are transmitted over the binary data lines between each of the three INS for continuous comparison to determine the position distance difference. The following formula which varies with t (time in NAV mode, hours) determines whether the distance criteria is exceeded.

$$\text{Distance Threshold (Nautical Miles)} = 3 + 3t \quad (\text{max } 25)$$

If the distance threshold is exceeded the INS being checked FAILS the test. When the distance threshold is not exceeded the INS being checked PASSES the test.

B. The distance threshold is computed and shown in the chart below for the time in NAV mode indicated:

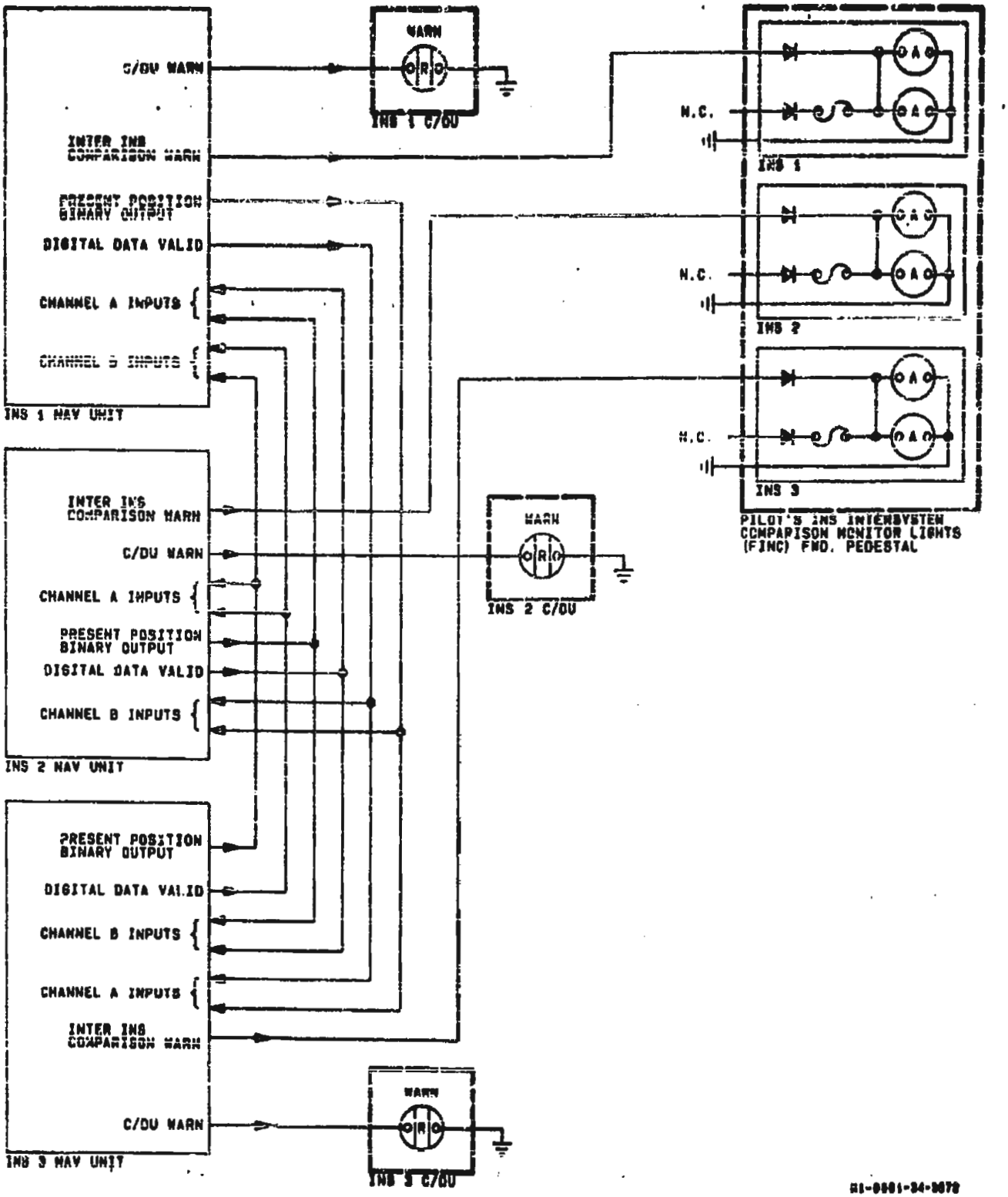
NAV Time (HR)	Distance (NM)	NAV Time (Hr)	Distance (NM)
0	3	6	21
1	6	7	24
2	9	8	25
3	12	9	25
4	15	10	25
5	18		

C NOTE: The maximum of 25 nautical miles difference between
C INS is required to assure meeting North Atlantic
C track separation criteria of 19 nautical miles
C crosstrack maximum 99.7% of the time. (25 NM radial
C distance)

C During ALIGN after position is inserted, if the
C insertion was performed incorrectly and the distance
C criteria is exceeded (more than 0.8 nautical mile
C difference) the INS being checked FAILS the test and
C lights the WARN light with action code 06.

C C. Several other checks are made simultaneously with the
C distance threshold check to determine that the transmitted
C data is valid. A continual comparison is made of the
C operating mode of each INS. If OFF or ATT is selected on
C the INS being checked, that INS outputs a Binary Warn (BW)
C signal. In addition the BW output indicates that a
C computation problem has developed. When the BW signal
C occurs the HSI displays of INS DISTANCE, GND SPD and TIME
C will be simultaneously covered by the shutter cover.
C Another check for transmitted data validity is the No Data
C (ND) signal. This is used to indicate the absence of all or
C part of the geographical position transmitted data from the
C INS being checked. An open wire or transmission line, a
C data garble or a parity error are possible causes of this ND
C signal. Whenever the INS being checked is in a different
C mode (ALIGN or NAV) from the checking system the ND signal
C will be generated.

C D. These checking criteria are inputs to a logic network within
C each INS navigation unit. As indicated, these input signals
C clearly define whether the INS being checked is transmitting
C valid data and then whether the distance criteria is being
C exceeded. Three logic outputs are generated by the
CR intersystem comparison system in each INS. These are
CR Intersystem Comparison, intersystem comparison check passed
CR or no change to intersystem comparison output. Each
CR navigation unit has the output of its intersystem comparison
CR logic network connected to its respective COMPARATOR Light
CR on the forward pedestal. One triple COMPARATOR Light panel
CR is labeled INS-1, INS-2 and INS-3 and lights are colored
CR amber.



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INS Intersystem Comparison Monitor
Figure 12

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E THE FOLLOWING CHART DELINEATES THE INTERSYSTEM COMPARISON SYSTEM LOGIC OUTPUTS WITH VARIOUS COMBINATION OF LOGIC INPUTS. ON THIS CHART, INS-1 IS THE CHECKING SYSTEM WHILE INS-2 AND INS-3 ARE THE SYSTEMS BEING CHECKED. THIS IS THE CASE FOR ABOUT ONE-THIRD OF THE TIME. DURING THE REMAINING TIME, INS-2 OR INS-3 IS THE CHECKING SYSTEM. THE LOGIC OUTPUT IS LISTED UNDER INS-1. THE ENTRIES INDICATE THE INS-1 COMPARATOR LIGHT OPERATION

FINC LIGHT OPERATION	BEING CHECKED	
INS-1	INS-2	INS-3
OFF	PASS	PASS
OFF	PASS	FAIL
OFF	BW	PASS
OFF	BW	BW
ON	FAIL	FAIL
ON	BW	FAIL
NO CHANGE	ND	ND
NO CHANGE	ND	PASS
NO CHANGE	ND	FAIL
NO CHANGE	BW	ND

CODE PASS - DISTANCE FORMULA NOT EXCEEDED
FAIL - DISTANCE FORMULA EXCEEDED
BW - BINARY WARNING DUE TO COMPUTATION PROBLEM OR AN INS AT ATT OR OFF MODE
ND - NO DATA DUE TO ABSENCE OF PART OR ALL TRANSMITTED DATA OR INS IN DIFFERENT MODE (NAV OR ALIGN)
NO CHANGE - COMPARATOR LIGHT STAYS ON IF PREVIOUSLY ON OR STAYS OFF IF PREVIOUSLY OFF THEREBY PREVENTING NUISANCE FINC LIGHT OPERATION.

C F. When an INS is in NAV mode (after NAV READY) and the CDU
CR Test button is pressed, the COMPARATOR lights will light for
CR a lamp bulb test. This procedure has to be repeated for
CR each INS system COMPARATOR Light to be tested.

C G. During alignment (before NAV READY), inserted position of
C each INS is used for comparison with the other two INS. If
C an INS position exceeds the 0.8 nautical mile criteria, that
CR INS will output a COMPARATOR signal but will not operate the
CR COMPARATOR light. Rather, the CDU WARN will light and
CR action code 06 with malfunction code 43 will appear on the
CR STS display. IN the event that no corrective action was
CR taken and all three INS continue alignment to NAV READY then
CR the CDU WARN will clear when the TEST button is pressed
CR successively to clean malfunction code 43 and the respective
CR INS COMPARATOR light will light. This will occur after all
C three INS have reached NAV READY.

C H. When one INS is down moded to OFF or ATT mode it can be seen
CR from the COMPARATOR Light Operation Chart that a Binary Warn
CR (BW) Logic output is generated. The two operable INS
CR continue transmitting position information to determine if
CR the distance criteria is exceeded. If this criteria is
CR exceeded by one INS, the fail Logic input is generated. A
CR fail logic with a BW causes the COMPARATOR light to light on
CR the checker INS. When the other operable INS performs the
CR checking, this same Logic combination will light its
CR COMPARATOR light also. In such an instance both operative
CR INS will have their COMPARATOR Lights lighted.

C 12. INS Signal Interface

C A. External Signal Inputs

C (1) External signal inputs to the INS are barometric
C altitude and true airspeed from the central air data
C computers (CADC). CADC No. 1 supplies INS No. 1 and
C CADC No. 2 supplies INS No. 2 and No. 3.

C B. Output Signal Interface

C (1) The overall INS interface is shown in Figure 2. In
C addition to the displays, the INS provides the
C following:

C (a) Stabilization signals to the weather radar system,
C keeping it level during normal maneuvers.

C (b) Navigation data and attitude to the
C autopilot/flight director system

C (c) Pitch attitude reference to the speed computer

C (d) Platform heading to the compass couplers of the
C magnetic heading reference system

C (e) Outputs to INS intersystem comparison monitor
C light that indicate when any navigation unit fails
C a present position comparison check.

C (f) Synchro and flag data to AIDS for maintenance and
C operational data recording.

C C. Intersystem Interface

C (1) Interunit Interface (Fig. 2)

C (a) The three INS systems are interconnected to allow
C any one system to accept data from the other two.
C Waypoint data loading is accomplished through data
C interchange on digital data lines between systems.

C (b) Each navigation unit has three digital data input
C channels, each channel consisting of clock, data,
C and sync signals.

C D. INS Instrument Switching

C (1) The transfer switching for INS navigation data is shown
C in Figure 14. The navigation display signals normally
C are applied from INS 1 to the captain's HSI and from
C INS 2 to the first officer's HSI. Selection of an
C alternate INS may be made by depressing the RNAV ALTN
C switch, which switches RNAV Accessory Unit relays. The
C RADIO/INS switch determines whether radio navigation
C data or INS navigation data will be displayed.

CR If the MSU is selected to ATT, only VOR or ILS data can
CR be displayed. If the RADIO/INS switch is in INS, NAV
CR and HDG flags appear on the HSI.

CR If the MSU is selected to NAV, information displayed on
CR the HSI depends on RADIO/INS switch position and VOR or
CR ILS frequency. If INS is selected with a VOR
CR frequency, INS data is displayed on the HSI perimeter
CR windows and course deviation bar. TRUE and RNAV are
CR displayed. If INS is selected with an ILS frequency
CR tuned, MAG and ILS are displayed; however, the HSI
CR perimeter windows continue to provide INS data with
CR course deviation and glide slope bars providing ILS
CR data. The HSI alert light is inoperative.

(2) The INS pitch and roll attitude signals drive the attitude display tape in the ADI. A flag signal is provided to the ADI's in case of loss or failure of attitude reference signals (Fig. 14). The attitude signals are normally routed from INS 1 to the captain's ADI and from INS 2 to the first officer's ADI. INS 3 is selected as alternate source for either ADI by depressing the ATT ALTN switch which operates alternate relays in the ADI.

(3) Platform heading signals from the INS are used by the magnetic heading reference system (MHRS) for compass stabilization. Refer to 34-21-00. Platform heading is applied from INS 1 to MHRS compass coupler 1 and from INS 2 to MHRS compass coupler 2 (Fig. 14).

A. Power for the INS system is derived from the essential, standby, and No. 2 ac extension buses.

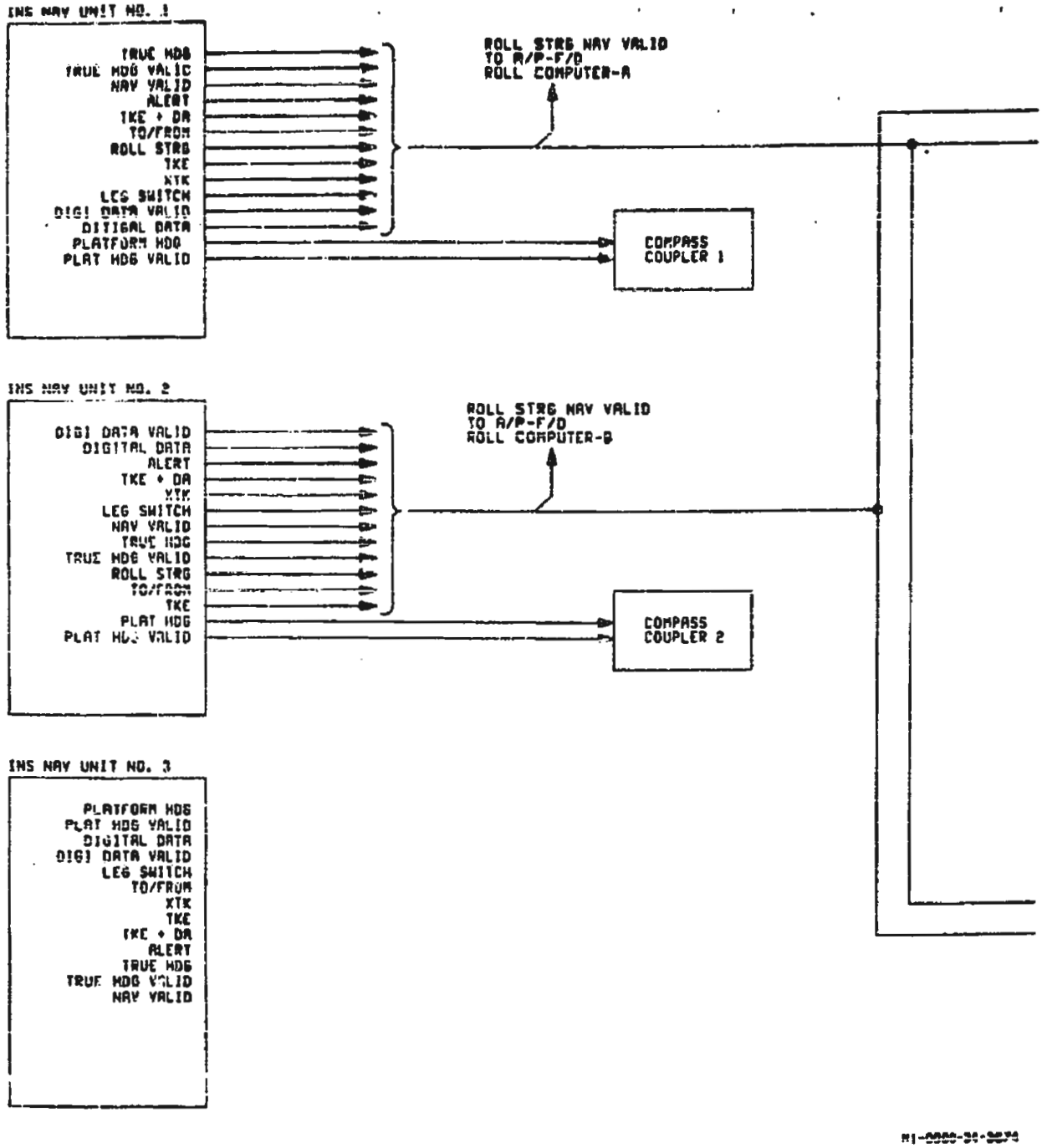
B. The system is energized by closing the circuit breakers which supply power to the navigation units, central air data computers (CADC), horizontal situation indicators (HSI), attitude director indicators (ADI), 26-volt ac autotransformers, and VHF NAV & RNAV Accessory units and INS Interface Units. The INS battery units contain individual thermal breakers which must also be closed to energize the system.

C. System power requirements include 115-volt ac primary power, 26-volt ac synchro power, 28-volt dc relay control power and 5 volts ac for panel lighting.

14. Operation

A. Functional Description, Operating Mode Control

(1) The INS has five major modes of operation which are controlled by the mode selector on the MSU. The major operating modes are off, standby, alignment, navigation, and attitude, selected by the OFF, STBY, ALIGN, NAV and ATT positions of the mode selector. When the INS is turned on for normal operation, the STBY, ALIGN, or NAV position of the mode selector can be selected and the INS will automatically sequence to the completion of the selected mode. The attitude mode can be selected directly during turn-on if only attitude signals are desired from the INS. By selecting the ATT position of the mode selector from the OFF position, the INS will sequence through standby operation to the attitude mode.



C INS Nav Data Simplified Switching Schematic
C Figure 14 (Sheet 1)

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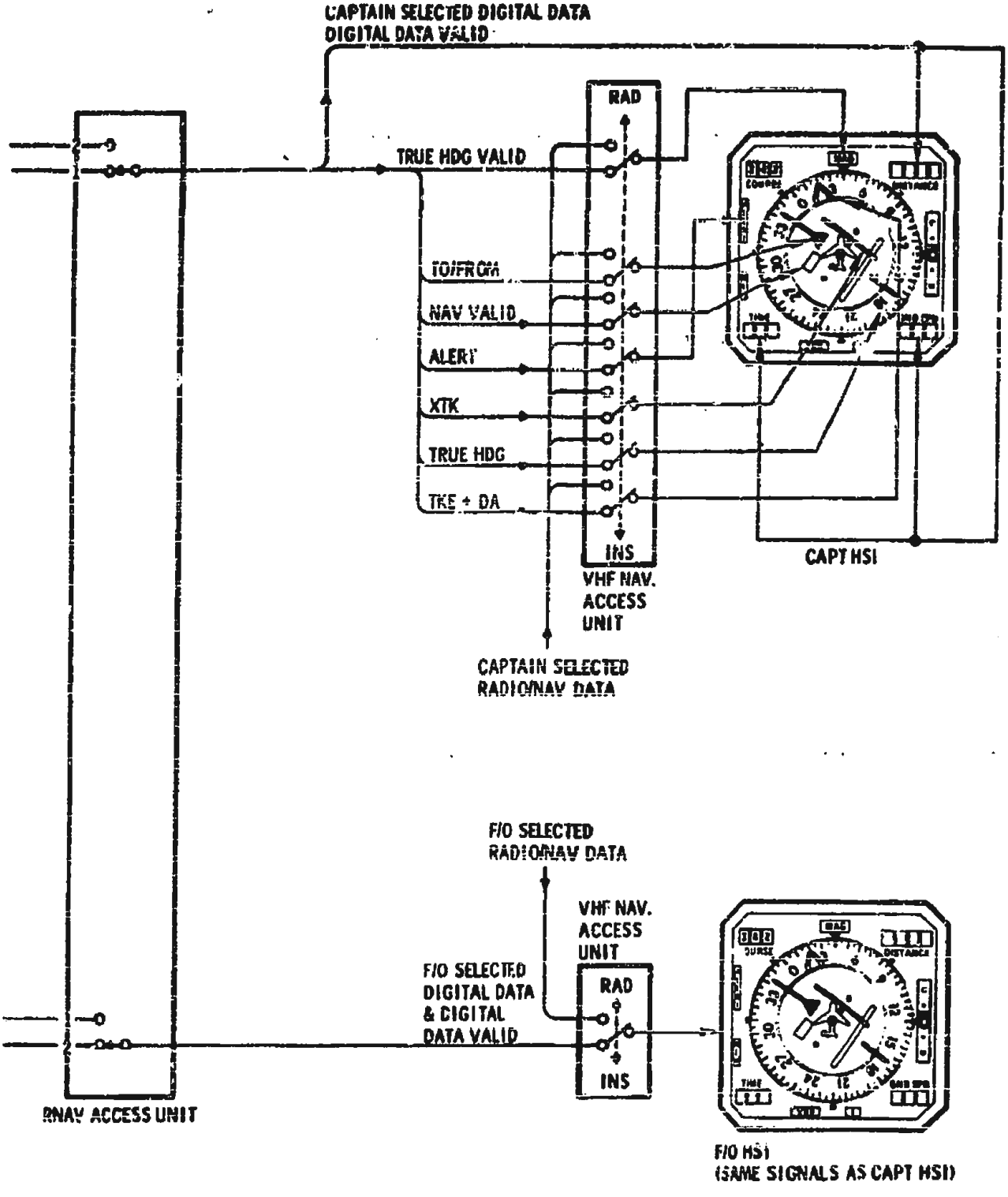

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C INS Nav Data Simplified Switching Schematic
C Figure 14 (Sheet 2)

C (2) If the mode selector is inadvertently moved from NAV to ALIGN during navigation mode of operation it will not change the INS operating mode providing the aircraft velocity is greater than 40 knots. Down-moding the INS from the navigation mode to the alignment mode can be accomplished only during ground operation by inserting present position after setting the mode selector to STBY and then to ALIGN. This causes the INS to restart the alignment process.

C (3) Moving the mode selector to STBY or ATT while the INS is in the alignment or navigation mode of operation will destroy the INS alignment. Selecting the attitude mode shuts off the DCU and CDU.

C (4) Off Mode

C (a) The INS is not functional when the mode selector on the MSU is in the OFF position. The 24-volt battery unit output power is applied to the mode selector to be available at turn-on (Fig.16). The 400-Hz excitation and reference voltages from the airplane systems are applied to the IRU pitch, outer roll, and platform heading synchros and to the DCU digital-to-analog converters when the INS is in the OFF mode. The 115-volt ac power from the airplane power system is applied to power relays in the NU which are open when the mode selector is at the OFF position.

C (5) Standby Mode

C (a) The standby mode of operation is an optional mode which prepares the INS for automatic alignment, but prevents alignment from being initiated. The standby mode is selected by turning the mode selector on the MSU to STBY.

C (b) During standby operation, the power supplies in the INS are energized, the fast warmup and fine temperature control circuits are enabled, the battery charger is enabled, the gimbal assembly is caged to the airplane pitch and roll attitude, and the DCU and CDU are enabled to allow insertion of data into the DCU.

C (6) Align Mode

C (a) Alignment of the INS takes place while the mode selector is set to ALIGN or directly to NAV from OFF or STBY. The alignment mode of operation is necessary to align the inertial instruments in the

vertical and horizontal planes, to allow the DCU to determine the exact orientation of the airplane with respect to true north, and to allow the DCU to determine any changes in accelerometer loop, gyro torquing, and stabilization loop errors since the last time the INS was operated. The alignment mode is automatically accomplished in five steps: gyro wheel runup, coarse leveling, coarse azimuth determination, fine leveling, and gyrocompassing. These five steps are preceded by a 130-second time delay period which ensures that the gyro wheels have attained the required speed and temperatures have stabilized.

(b) The present position latitude and longitude must be inserted through the CDU before the DCU will complete the coarse azimuth alignment. The DCU computes the earth rate for the inserted latitude and uses this value to compute a value of local latitude. The inserted latitude and computed latitude are then compared for reasonableness. A difference of approximately 2.0 degrees or more will cause the WARN lamp on the CDU to light. The total time of the coarse azimuth step of alignment is 120 seconds providing present position latitude and longitude are inserted prior to the end of the 120-second period.

(c) An overtemperature condition in the NU will cause the INS to shut down if the mode selector is set to ALIGN. If the INS is being aligned with the mode selector at NAV, the INS will not shut down. An overtemperature condition, a loop monitor detected malfunction, or a computer detected malfunction can be displayed on the CDU.

(d) Fine leveling platform alignment is a refinement of the coarse azimuth alignment. The DCU resets all warning discretes and eliminates all malfunction codes stored in memory at the beginning of fine leveling.

(e) During gyrocompassing, the DCU checks various data being generated for reasonableness. These checks are in addition to the continuously performed self-checks for software and hardware. If any of the values checked for reasonableness are out of tolerance, the CDU WARN discrete from the DCU drops to zero causing the WARN lamp on the CDU to illuminate.

(f) The INS computer checks the computed (actual) performance index number against the desired performance index number (PI = 5). The computer will insure the MS RDY discrete to light the READY NAV lamp on the MSU when the two performance index numbers are equal, indicating that the desired degree of alignment has been attained. If the mode selector is left at ALIGN after the READY NAV lamp lights, the fine leveling and gyrocompassing operations will continue to further refine the INS alignment and lower the actual performance index number. If the mode selector is set to NAV before the READY NAV lamp lights, the DCU will automatically enter the navigation mode of operation and lgith the READY NAV lamp after it has aligned to the desired perofrmance index.

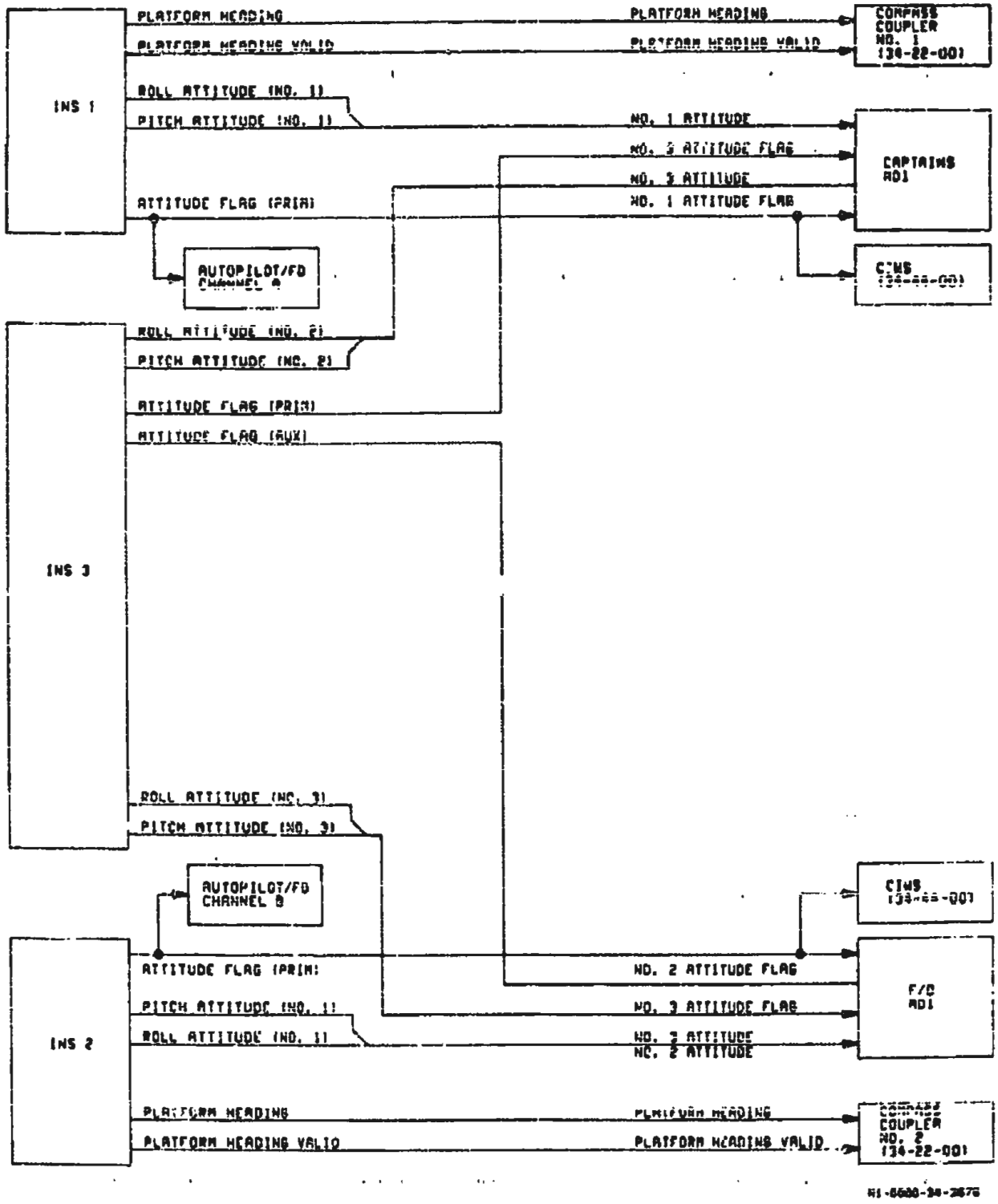
(7) Navigation Mode

(a) The navigation mode of operation takes place when the mode selector is set to NAV only after the actual performance index number displayed on the CDU has decreased to a value equal to or less than the desired performance index number. When the actual performance index number reaches the desired level, the DCU continuously checks for the MS NAV discrete from the mode control logic. Once the MS Nav discrete is present, the DCU begins computing navigation data.

(8) Attitude Mode

(a) The attitude mode of operation is selected by setting the mode select switch to ATT. The switch must be pulled and turned to enter or exit the ATT position. This mode of operation can be used if navigation and/or steering data signals become inaccurate (indicated by illumination of the of the WARN lamp and appearance of instrument flags). Setting the mode selector to ATT causes shutdown of the DCU. At the same time, the CDU is disabled except for the DAT and WARN lamps. Illumination of the WARN lamp during attitude operation will indicate that the attitude output signals are inaccurate and the INS should be shut down. INS navigation reference data is lost once the DCU is shut down, therefore, the NAV mode of operation cannot be regained during flight after the ATT mode of operation has been selected.

(b) Shutdown of the DCU in the attitude mode of operation destroys alignment, and the navigation



CR INS Attitude and Compass Stabilization Simplified Schematic
CR Figure 15

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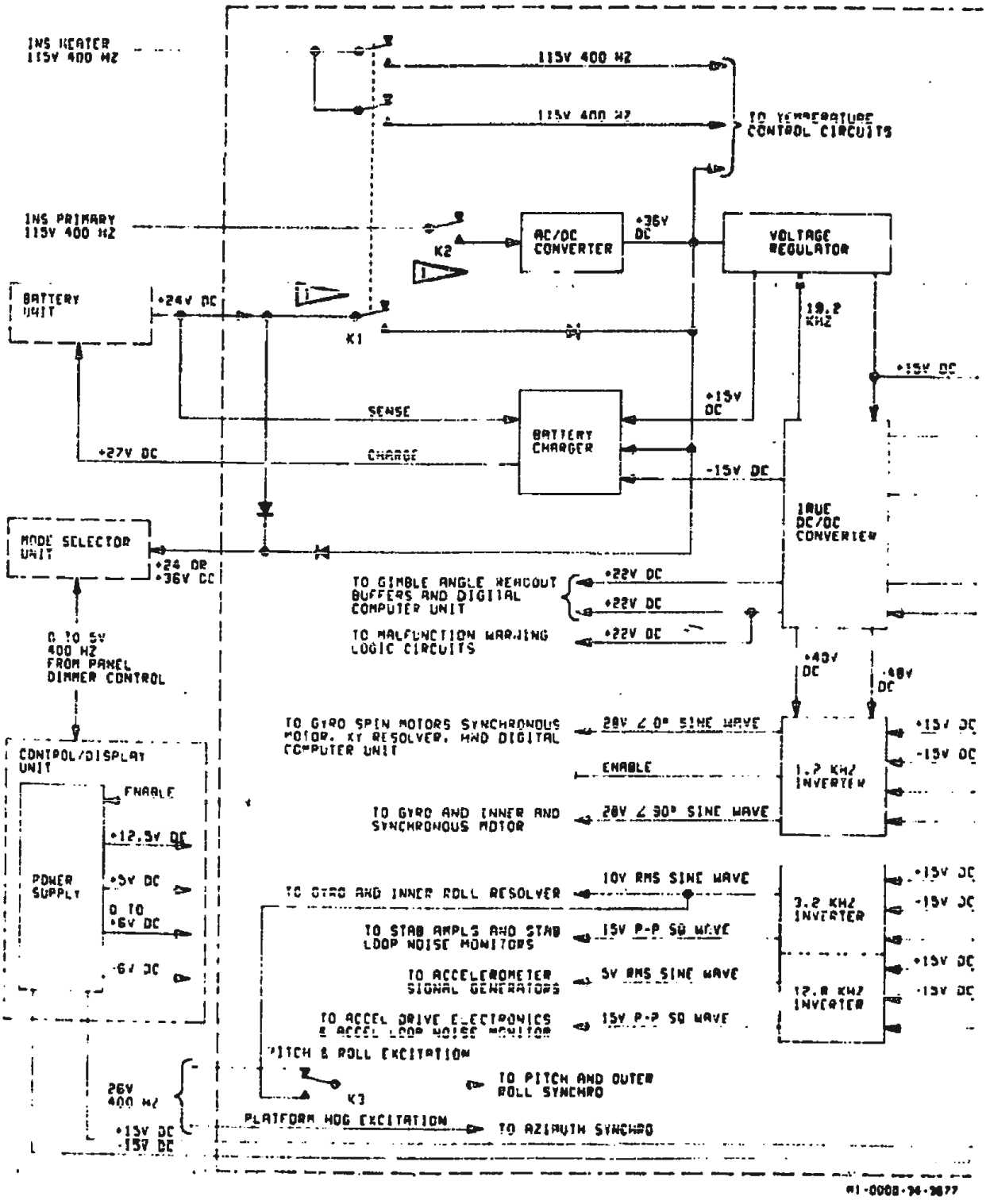

CR Power Control and Distribution Circuits Block Diagram
CR Figure 16 (Sheet 1)

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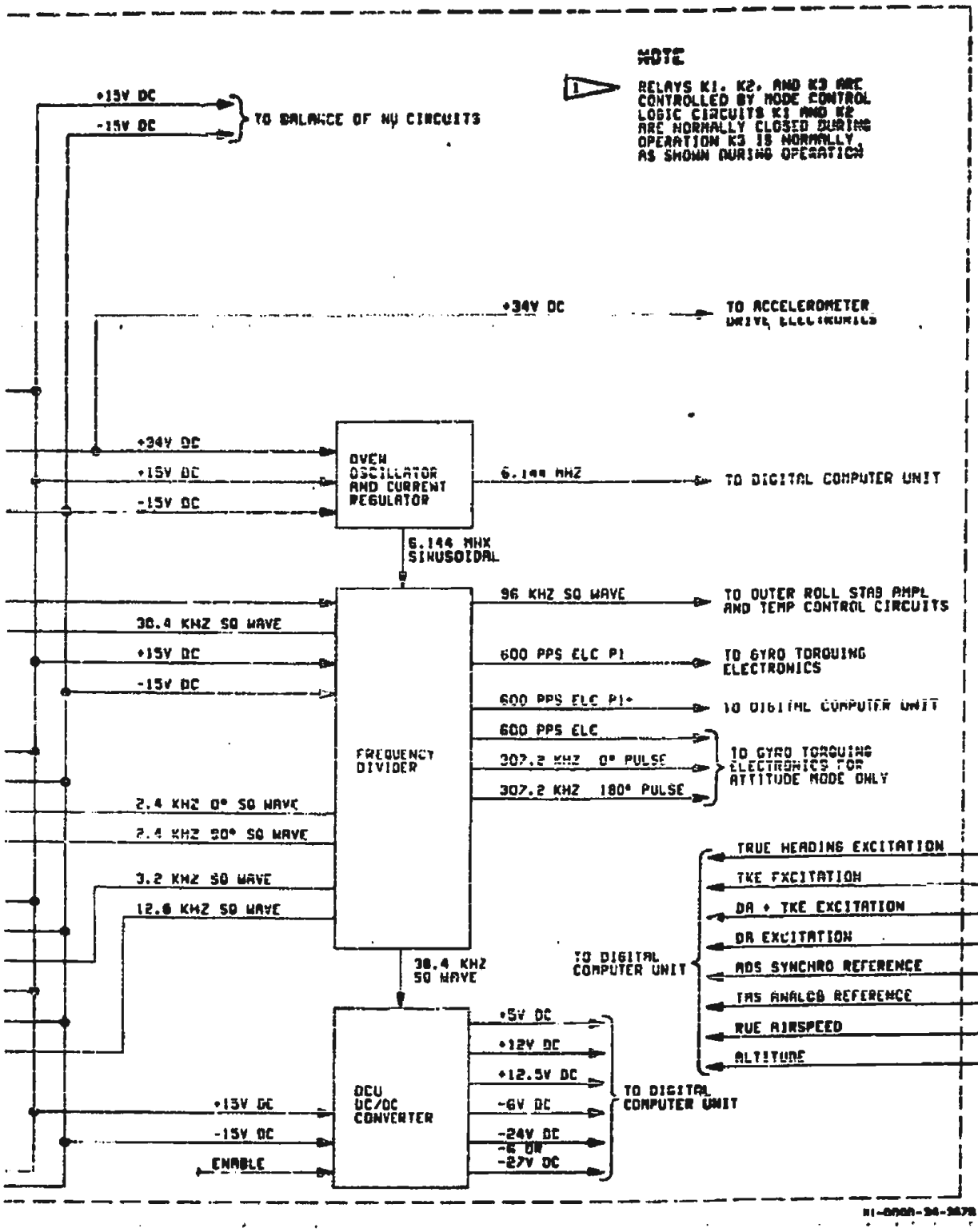


CR Power Control and Distribution Circuits Block Diagram
CR Figure 16 (Sheet 2)

mode of operation cannot be selected until the INS is automatically aligned on the ground. The attitude mode can be selected during ground operation by setting the mode selector directly to ATT from any other position.

(9) Gimbal Slew (See 34-43-05 Maintenance Practices)

(a) Gimbal slew allows the simulation of airplane attitude movements without the use of a tilt table or removal of the INS navigation unit from the equipment rack. The resulting outputs enable the checkout of INS attitude signal interfaces and the calibration of interfacing systems.

(b) Gimbal slew is initiated by inserting a special P28 gimbal slew test connector (A.C. P/N 7888466), into J28 on the front of the INU. When the test connector is inserted, the WARN light comes on and action code 00 is displayed if the data selector switch is set to DSRTK/STS. The mode selector is set to ALIGN and the navigation unit aligns in a normal manner through Mode 7. When Mode 7 is completed (PI is 6), the gimbal slew mode is automatically entered.

NOTE: In order to complete INS alignment, present position data must be loaded before the navigation unit can complete Mode 7.

(c) In normal INS operation, there is a small platform offset with respect to gimbal angles (off level) due to noise from electrical coupling in the gimbal area. This offset is measured during manufacturing and a gimbal oriented bias (GOB) correction factor is inserted into the INS computer memory. In normal operation, the computer uses the GOB factor to torque the gyros for leveling of the gimbals. In the gimbal slew mode, the GOB factor is automatically stored and replaced with a new correction factor for gimbal slew. When the HOLD light is off, a large bias correction factor is applied causing the computer to torque the gyros (at maximum torquing rate) in an attempt to correct for this correction factor. When the HOLD light is on, a zero bias correction factor is applied and the computer stops torquing the gyros. Because the roll gimbal axis becomes unstable near 90 degrees pitch, the computer stops all torquing when 71 degrees in pitch or roll is reached.

C (d) Slewing is commanded with the HOLD light off. The pitch and roll gimbals are slewed at approximately 2 degrees/min. The selection of pitch or roll is determined by the position of the AUTO/MAN switch. AUTO provides pitch slewing and MAN provides roll slewing. If the REMOTE light is illuminated, the torquing will be down in pitch or left in roll; if the REMOTE light is out, the torquing will be up in pitch or right in roll.

C (e) Azimuth torquing is normally accomplished by pitch slewing to a finite angle followed by roll slewing. The azimuth slew rate is approximately proportional to the sine of the gimbal pitch angle. The maximum azimuth slew rate is about 1/2 degree per minute.

C (f) Releveling the platform can be accomplished in two ways. One way is to reverse the direction of slew until zero attitude is achieved. The other way is to turn the mode selector to OFF, allow the gyros to run down for 2 minutes and then repeat the "align" process in preparation for the next test.

C (g) Post gimbal slew procedures for returning to normal INS operation are as follows:

CR 1) Remove the gimbal slew test connector from J28 on the front of the navigation unit and replace the J28 test connector access coverplate.

CR 2) Verify data selector switch in DSRTK/STS position. INS downmodes to course level (P.I. = 8).

CR 3) Turn the mode selector to OFF.

CR 4) Wait 2 minutes and set the mode selector to ALIGN.

CR 5) Insert present position and allow INS to align until actual PI number reaches 6.

CR 6) Push HOLD light to ON. Verify that no C malfunction codes are displayed.

C NOTE: If the INS is no longer required, restore airplane to normal. (Ref to INS - Adjustment/Test.)

C B. Functional Description, Self-Test Procedures

C (1) The TEST switch can be pressed at any time during INS operation to test the indicating lamps and displays on the MSU and CDU and the DCU input/output. Proper operation is indicated by illumination of all lamps and displays while the switch is pressed. Each digit in the FROM/TO display and data displays is lighted to indicate an 8. The directional letters (N S E W) are also lighted in the data displays.

C (2) Illumination of the WARN lamp can be caused by either an intermittent or a continuous out of tolerance condition. Pressing the TEST switch wile the WARN lamp is lighted will reset the DCU warning circuits and the WARN lamp will go out if the condition is not persistent. If the WARN lamp remains illuminated, the malfunction persists and may impare system performance.

C (3) Pressing and releasing the TEST switch while the data selector is at DSRTK/STS will display any malfunction codes in the second and third digits of the right hand data display. When the WARN lamp is illuminated, additional malfunction codes can be displayed by additional TEST switch operation. If more than one failure is detected by the DCU, each actuation of the TEST switch will display another malfunction code until all current malfunction codes have been displayed. Actuation of the TEST switch after all current malfunction codes have been displayed will cause the two digits to go blank.

C (4) The DCU stores a record of all failures, whether intermittent or persistent from the start of fine leveling in the alignment mode until the next time the DCU enters the fine leveling mode. The DCU memory can be interrogated to determine all failures that have occured during this period.

C C. Controls

C (1) Prior to operating the inertial navigation system, electrical power must be provided to the aircraft (Ref. 24-22-00), Electrical Power, Manual Control), the central air data computer system must be operating (Ref. 34-14-00), Central Air Data Computer System - Adjustment/Test), both RADIO/INS switches (located on pilot's forward pedestal) should be in the INS position, and the equipment cooling system should be operating (Ref. 21-25-00, Equipment Cooling System).

C CAUTION: DAMAGE TO ELECTRONIC EQUIPMENT CAN RESULT IF THE EQUIPMENT IS OPERATED WITHOUT PROPER EQUIPMENT COOLING.

C (2) The INS circuit breakers listed in Figure 18 must be
C closed.

C (3) Turn-on of the INS involves alignment of the system and
C its operation in the NAV mode. The INS is now prepared
C to accommodate normal system operational test
C procedures (Ref to INS - Adjustment/Test).

CR 15. INS Computer Program (After M080A59)

CR A. The "TWA 31N-A1" INS computer program is the current INS
CR computer program for loading into all INS navigation units.

CR B. An identification placard is installed on the front plate of
CR the Nav Unit stating "TWA-31N-A1" Delco P/N 7884663-020, CDU
CR Ident "63-20".

CR C. The "TWA 31N-A1" INS computer program includes the features
C of previous INS computer programs with several additional
C operational and maintenance improvements:

CR (1) Provides dynamic aircraft parameters to 747SP autopilot

CR (a) Six special parameters are output for use by the
CR 747SP autopilot Landing and Roll-out Computer
CR (LRCU) to allow Category II/IIIA approaches and
CR landings. These parameters are output in digital
CR bus every 100 milli-seconds as listed below:

CR	Parameter	Range
CR	Cross-body acceleration	± 0.5 g
CR	Cross-track acceleration	± 0.5 g
CR	Vertical acceleration	± 0.5 g
CR	True heading rate	25°/second
CR	Along-track acceleration	± 0.5 g
CR	Ground speed	0-250 knots

CR (b) These outputs are discontinued when a CDU WARN
CR light is illuminated, an HSI NAV flag is in view
CR or a malfunction code 50 exists.

CR (2) Along track acceleration display

CR (a) Along track acceleration/deceleration (along the
CR ground track of the airplane) is displayed on the

CR CDU TK/GS display when the HOLD button is
CR illuminated. In place of the track (TK) angle
CR display, the left display will be blank for
CR acceleration and "N" (negative) for deceleration.
CR In place of the ground speed display, the right
CR display will display milli-g's of along-track
CR acceleration/deceleration.

CR NOTE: 32 milli-g's is equivalent to 1
CR knot/second.

CR (3) CDU "FROM" display flashes if an active waypoint is
CR selected.

CR (a) During NAV with WYPT selected, at ground speeds
CR greater than 200 knots, the FROM side of the
CR FROM-TO display will flash at 0.6 second rate if
CR an "active" waypoint has been selected on the
CR thumbwheel selector.

CR (b) An "active" waypoint is either the FROM or TO
CR waypoint defining the current flight leg. The
CR flashing FROM side display will provide a caution
CR indication to prevent an inadvertent autopilot
CR transient with the INS coupled to the autopilot.
CR The autopilot should, of course, be disconnected
CR while changing active waypoint data.

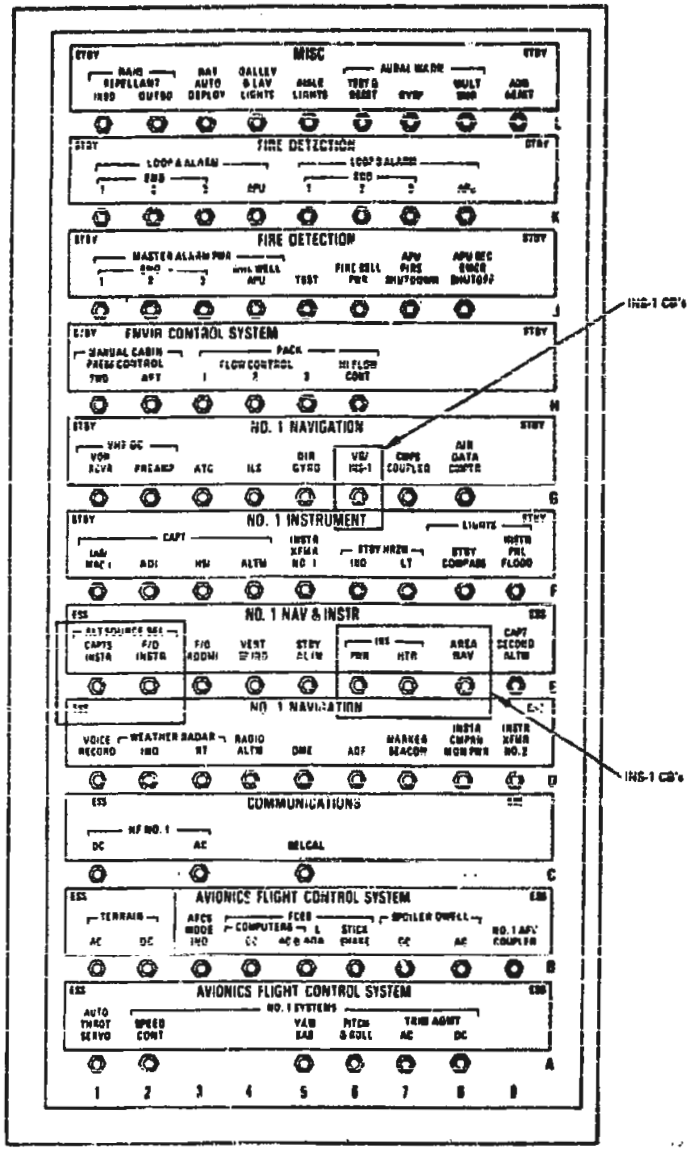
CR (4) FROM-TO display change to unloaded TO waypoint is
CR prevented

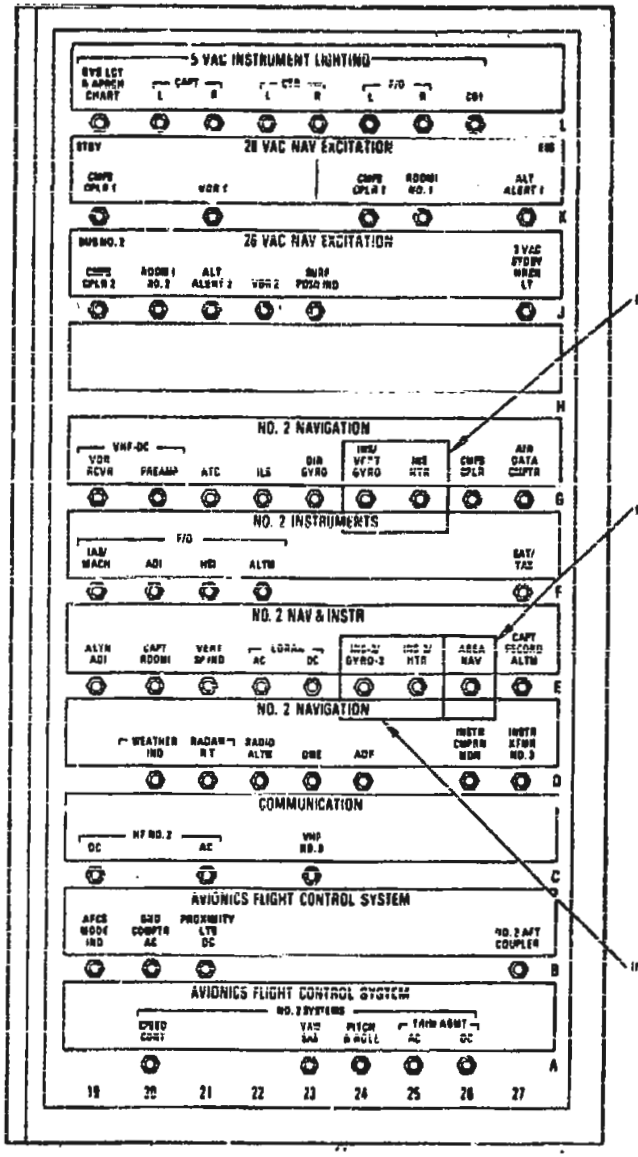
CR (a) When the AUTO-MAN switch is positioned to AUTO and
CR no waypoint data (lat/long) has been loaded into
CR the next waypoint, the FROM-TO will not sequence
CR to the next waypoint pair. Instead, the ALERT
CR light will flash as if MAN was selected on the
CR AUTO-MAN switch. Loading waypoint data into the
CR next waypoint will extinguish the blinking ALERT
CR light.

CR (5) Wind shear conditions indicated by flashing "88888" in
CR left WIND display (HOLD illuminated)

CR (a) The right WIND display (HOLD illuminated) will no
CR longer flash when wind shear conditions exist.
CR Instead, it will continuously display wind-on-nose
CR (or tail) knots. The left display will flash
CR "88888" when wind shear conditions exist.

CR (6) Action/Malfunction Code 02-56 is changed to 06-56





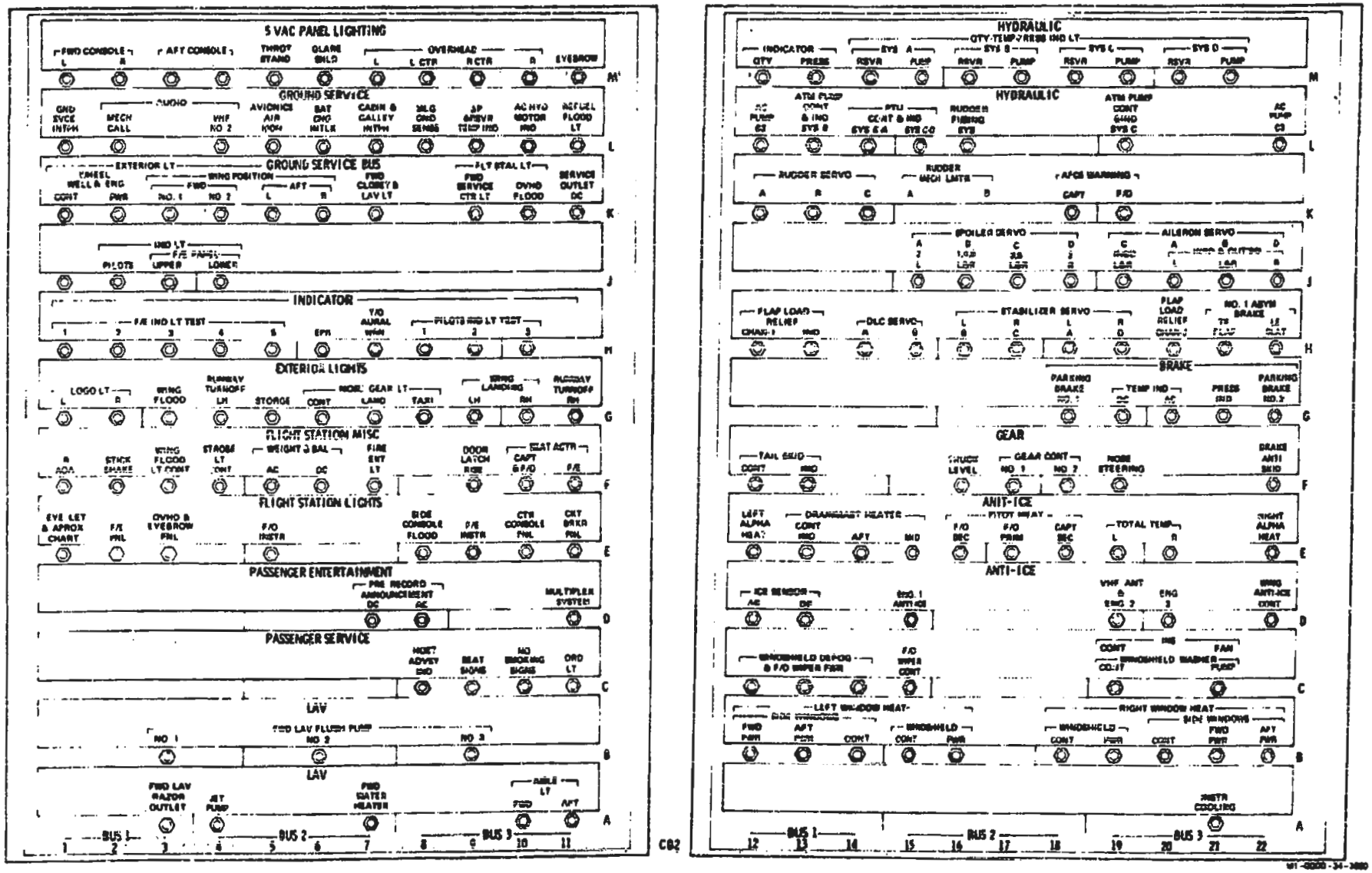
M1-0000-34-3679

CR
CR

INS Circuit Breaker Location (CB-1)
Figure 17 (Sheet 1)

EFFECTIVITY:INS EQUIPPED AIRCRAFT

006B



C
CR

INS Circuit Breaker Location (CB-1)
Figure 17 (Sheet 2)

EFFECTIVITY:INS EQUIPPED AIRCRAFT

0068

CR (a) Malfunction Code 56 [triple mix position disagrees
CR with inertial position by greater than 3+3T (T=Nav
CR Hours) nautical miles] is being revised to Action
CR Code 06 to mean, in flight, "check INS present
CR position display for accuracy, or manual update is
CR too large".

CR (b) Previously, Action Code 06 would appear only
CR during present position insertion on the ground.
CR It can now appear in flight during triple-mix
CR operation or after a manual position update. The
CR WARN light can be cleared by selecting DSRTK/STS
CR and pushing TEST button sequentially as presently
CR accomplished.

CR (7) Improved REMOTE waypoint loading

CR (a) Waypoint data transmissions to receiving INS have
CR been increased to improve remote loading. Now
CR each waypoint is transmitted for approximately 1.8
CR seconds to assure that the receiving system
CR obtains the waypoint data.

CR (8) Improved check for low synchro excitation

CR (a) Synchro excitation voltage was previously checked
CR relative to a 3-volt AC level. This check is now
CR made relative to a 20-volt AC level to sense
CR adequate AC excitation in connection with
CR malfunction codes 22, 23, 24, and 25.

CR (9) Improved roll steering output test (L-1011 application
CR only)

CR (a) The autopilot interface test used during the INS
CR functional test is improved to fully simulate the
CR X-Z and Y-Z voltages.

CR (10) Improved gimbal slew test outputs

CR (a) The gimbal slew test used in the INS functional
CR test previously tended to drift off the selected
CR attitude. An improvement is added to lock-in the
CR attitude at the selected attitude.

CR (11) Additional features are added for improved shop
CR operation and troubleshooting.

CR D. Features included from previous program revisions are
CR described below:

C Wind-on-nose/tail display. When WIND is selected on the CDU
C data selector and the HOLD button is lighted, the WIND
C display now shows wind-on-the-nose/tail. The displays will
C appear as shown below:

C "N" (nose) head wind	"10" (knots of wind along
C "S" (stern) tail wind	nose-tail axis of
C	aircraft)

C (2) Wind shear characteristic indicator. The wind-on-nose
C display (knots) will blink when sustained horizontal or
C vertical wind shears are experienced that exceed 1 knot
C per second and 2 knots per second downward
C respectively. The display will blink for three seconds
C following the wind shear encounter. Vertical wind
C shears can be distinguished from horizontal wind shears
C by a blinking display but constant wind-on-nose
C numbers.

C (3) Waypoint thumbwheel number repeated in FROM display.
C The waypoint number selected on the CDU thumbwheel
C switch is repeated on the FROM side of the FROM/TO
C display when WAYPT is selected on the data selector
C switch. This provides an electrical verification of
C the waypoint thumbwheel position as well as an enlarged
C waypoint selection display. When the WYPT CHG button
C is depressed, the FROM/TO display will revert to show
C the active FROM/TO track being flown and will respond
C normally until the INSERT button is depressed. After
C INSERT is depressed, (extinguished) the FROM side will
C again show the WAYPT selector numeral and the TO side
C will be blank.

C (4) Computer program identification display. The INS
C computer program identification (part number) is
C displayed on the left display when DSRTK/STS is
C selected on the data selector switch and the HOLD
C button is lighted. During this time the left display
CR will show "63 * 20" (* means blank display) indicating
CR "TWA 31N-A1" program incorporated. Pressing HOLD to
C extinguish will return DSRTK/STS display to normal.

C (5) Ramp departure point insertion storage. The ramp
C (departure point) position coordinates (latitude and
C longitude) are stored in waypoint "0" when HOLD button
C is lighted and will not change throughout the flight.
C These coordinates will remain until the next alignment
C coordinates are inserted.

C (6) Action code "06" for improper position loading/update.
C Action code "06" will be displayed whenever the INS
C position comparison has determined that an improper

C position insertion/update has taken place. The
C following malfunction codes are associated with action
C code"06":

Malf Code	Malfunction
43	CDU Warning after position insertion if an error over 0.84 miles has been made during alignment in comparison to other INSs.
58	Position insertion error on ground is greater than 3 + 3T (T is equal to Nav time of previous flight) miles from the stored position of the last INS shutdown.

C (7) Improved WIND readout during approach/takeoff. The INS
C uses TAS from a CADC to calculate wind direction and
C speed. The CADC now provides a lower TAS to the INS
C (approximately 115 knots at lowest total air
C temperature). Instantaneous raw wind readouts or the
C CDU WIND display may now be used for more accurate wind
C information and possible wind shear determination at
C aircraft approach/landing speeds.

C (8) Improved INS Comparator light operation. The INS
C Comparator Light operating logic is improved by
C revising the formula for illuminating lights. The new
C formula will illuminate the respective light when
C radial distance (pure inertial plus manual updates, if
C any) between INS's displayed position exceeds 3 + 3T (T
C = Nav hours). In addition, when this formula equals or
C exceeds 25 nautical miles, the INS comparator light for
C the deviating system will illuminate regardless of time
C in navigation mode.

C (9) Program identification CDU display. The CDU will
C display the program identification on the DSRTK/STS
C left display (DSRTK) when the HOLD key is depressed
C (illuminated) and will show "63 * 20" (* indicates
CR blank) indicating "TWA 31N-A1" program. Pressing the
C HOLD key the second time to extinguish it will return
C the DSRTK to normal display.

C (10) Triple position mix capability.

C (a) Triple position mixing of INS positions is the
C computation and display of an optimum present
C position using valid data from three operating
C INSs. Each INS does its own position updating
C independent of the other two systems (regardless
C of computer program incorporated) and all three
C systems must be operating in navigation mode and

must not have a data warning flag. Only the INS(s) commanded to do triple mixing will display the triple mix position.

(b) In triple mixing the position displayed and used for autopilot steering and all CDU navigation displays is the middle latitude and longitude of the three INS displays. For instance, the latitude display of No. 1 INS and the longitude of No. 3 INS would be displayed on the No. 1 INS CDU thereby "making" a new position (the triple mix position). The triple mix latitude displayed is that latitude which is between the furthest north and south latitudes of the three INSs. The triple mix longitude displayed is that longitude which is between furthest east and west longitudes of the three INSs.

(c) A malfunction code 56 with action code 06 monitors the triple mix position display and compares against that INSs' pure inertial position. If the distance comparison exceeds 3 + 3T (T = hours in navigate mode) nautical miles, the CDU WARN light will illuminate with action code 06 and malfunction code 56. Pressing the CDU TEST button will clear the CDU WARN but the 06 action code and malf code 56 will not clear indicating that the triple mix position is grossly in error or the pure inertial of that INS is grossly in error. The inertial position can be displayed by selecting DSRTK/STS and inserting a "1" and selecting "POS". Checking the position against the arrival gate position and determining radial error will determine whether navigation unit replacement is necessary.

(d) Triple mixing is commanded on an INS by selecting DSRTK/STS and inserting a "4" after NAV mode is reached. The right display will show 1 * * * 54 (* denotes blank). The position display will now start to triple mix. Approximately five minutes later the position display will show the triple mix position and will continually maintain the triple mix position. The triple mix position display has been demonstrated to be 40% more accurate than any one of the INSs selected at random. One INS or all three INSs can be commanded to triple mix at any particular time. All INSs triple mixing will display the same position and other navigation displays.

C (e) To return to inertial position display, DSRTK/STS
C is selected and a "5" is inserted. The right
C display will now show 1 * * * 55 (* denotes
C blank). The position display will start from the
C triple mix position and display single INS drift
C from that time forward. To return to the stored
C pure inertial position display, DSRTK/STS is
C selected and a "1" is inserted (display will read
C 1 * * * 55). The CDU display will immediately
C return to pure inertial position and the triple
C mix position is lost. During triple mixing, the
C pure inertial position can be temporarily
C displayed by selecting WYPT and rotating waypoint
C thumbwheel to waypoint 1 thru 9 (not 0).
C Returning the selector to POS will again show
C triple mix position.

C (11) INS track capture easy-on.

C (a) An INS track capture easy-on feature is
C incorporated to provide automatic INS track
C capture with desirable (normal) aircraft roll
C rates. This allows INS automatic capture while
C still off the INS desired track thereby
C eliminating the need for manual capture with
C heading mode. The easy-on will be commanded when
C WYPT CHG, INSERT keys are depressed. The
C autopilot should be immediately coupled to INS to
C assure desirable roll rates.

C (b) The INS track capture easy-on feature described
C above is also incorporated in the WYPT CHG X-Y,
C INSERT and the WYPT CHG, O-X, INSERT procedures
C that are presently used during in-flight
C diversions or flight plan changes in the event the
C autopilot is engaged immediately thereafter.

C (12) Deletion of variable desired performance index (PI).

C (a) The "desired PI" number can be inserted only after
C the NAV mode has been entered, and is used, not to
C designate a desired PI, but to select normal
C inertial operation or triple mix operation and to
C eradicate previous position fixes. Desired PI of
C 5 appears at INS turn-on.

C (13) INS steering command to autopilot.

C (a) The INS provides steering commands (roll commands)
C to the autopilot to establish and maintain the
C aircraft on track. This command varies with
C ground speed, cross-track distance and track angle

C change; the maximum roll command (bank angle) will
C be approximately 20 degrees consistent with
C passenger comfort.

C (14) Inhibit of malfunction 58 at first installation.

C (a) Malfunction code 58 is inhibited on the first
C installation of an INS navigation unit out of
C stock. On previous programs, the malfunction code
C 58 would occur because the inserted position
C disagreed with shutdown position (MCI) by more
C than 30 miles. A digital value is inserted in the
C MCI shop to inhibit malfunction code 58 on the
C first alignment in the airplane.

CR E. Automatic Pre-Flight Update

C (1) The "Automatic Pre-Flight Update" feature automatically
C calibrates the INS platform-instrument parameters at
C the beginning of each flight for improved navigation
C accuracy. INS navigation performance of the previous
C flight is used to determine the specific amount of
C calibration required. This technique formerly
C performed by the flight crew at the conclusion of the
C flight (post-flight-updated) is now completed
C automatically during alignment before the start of the
C next flight.

C (2) To calculate the amount of calibration required, the
C INS computer stores the arrival gate latitude and
C longitude (shown on the CDU) until the INS is turned on
C for INS alignment of the next flight. The present
C position latitude and longitude inserted as part of the
C alignment procedure are compared with the stored
C arrival gate INS position. A difference calculation is
C performed by the INS computer. This difference
C latitude and longitude is used to determine calibration
C values for the INS platform-instrument parameters. The
C numerical amount of the calibration value is
C proportioned and stored in the INS computer.

C (3) The automatic pre-flight update feature accomplishes
C this calibration without added flight crew workload and
C without the possibility of manual insertion errors.
C This automatic technique maintains INS accuracy better
C than approximately 1.5 nautical miles (radial error)
C per flight hour without periodic ground or shop
C calibrations. In addition, this feature provides a
C desired performance index (PI) of 5 on the
C Control/Display Unit (CDU) at INS turn-on and requires
C approximately 15 minutes for completion of the INS
C alignment sequence.

C (4) The automatic pre-flight update will not occur if any
C of the following conditions occur:

C (a) The INS Mode Selector Unit (MSU) switch is rotated
C to OFF when INS ground speed is greater than 40
C knots.

C (b) The difference latitude and longitude calculation
C (mentioned above) results in a total-distance
C (straight line) error of more than 32 nautical
C miles.

C (c) A manually-inserted, post-flight update was
C performed at the conclusion of the flight before
C the MSU was moved to OFF.

CR F. Nav Ready Lamp (Continuous in Nav Mode)

C (1) The NAV READY lamp on the MSU will remain lighted when
C the MSU switch is in the NAV position and the desired
C PI has been attained. This operational feature will
C provide assurance to the flight crew that the INS has
C completed its alignment sequence. The alternate method
C to determine NAV READY is still applicable:

C (a) Rotate the Control Display Unit switch to
C DSRTK/STS;

C (b) Check that the right, upper display digits have
C changed from 0 - - - 65 to 1 - - - 55.

CR G. "01" From/To and Automatic Insertion of POS

C (1) The CDU From/TO will be "01" at INS turn-on. The POS
C (present position) inserted during alignment is also
C inserted automatically in waypoint "0". The from/To
C will not cycle continuously since waypoint "0" (present
C position) and waypoint "1" (0° latitude and 0°
C longitude) are separated geographically and a valid
C track is established. When flight leg "89" is
C completed, the From/To will change to "91".

CR H. Automatic POS Insertion During Flight

C (1) POS (present position) will automatically be inserted
C in waypoint "0" whenever "0" is placed in the "From"
C display, the desired waypoint is placed in the "To"
C display and INSERT is depressed. In this manner a new
C desired track is established from that particular
C present position to the selected waypoint. When "0" is
C placed in the "To" display, the desired waypoint is
C placed in the "From" display and INSERT is depressed,

C the existing waypoint "0" is used to define the new
C desired track. In this case, present position is not
C transferred to waypoint "0"; instead the previous
C waypoint "0" coordinates are used and remain unchaged.

CR I. DIS/TIME Readout

C (1) A DIS/TIME readout from POS to (or from) a selected
C waypoint is available by placing "0" in the "From" (or
C "To") display on the CDU and the selected waypoint in
C the "To" (or "From") display. This is accomplished
C without depressing INSERT: therefore, desired track is
C not changed. To return the FROM/TO display to its
C original numbers, press CLEAR. This process causes no
C interference with the INS outputs to the
C Autopilot/Flight Director. The TIME display is
C calculated using existing ground speed at that time.

CR J. New "Reinsert Present Position" Action/Malfunction Code

C (1) When POS is inserted at INS turn-on, a comparison of
C inserted POS and the last INS POS (at last INS
C shutdown) is performed to determine if a difference
C (insertion error) of over 3 + 3T (T = Nav hours of last
C flight) miles latitude or longitude exists. When such
C an error exists, the CDU WARN lamp will light and an
C "06" action code will register on the STS display.
C Pressing the TEST button will register malfunction code
C 58 on the STS display indicating Go to STBY REINSERT
C PRESENT POSITION.

C NOTE: Navigation units should not be removed from the
C aircraft for this action/malfunction code.
C Rotate MSU to STBY and reinsert position two
C times. Select DSRTK/STS and clear malf code 58.
C Select NAV on MSU and wait for READY NAV green
C light.

CR K. Attitude/Heading Slew Maintenance Tests

C (1) The INS platform can be artifically tilted by inserting
C a special J-28 mating plug in the navigation unit
C computer interface connector (located on the navigation
C unit front).

C (2) A series of CDU actions described in 34-43-00
C Adjustment/Test of the Maintenance Manual will allow
C pitch and roll gimbal slewing. This is accomplished
C without removing the navigation unit from the rack.

C 16. INS Operating Procedures

C A. No maintenance requirement exists for the INS to be operated C in NAV for extended periods of ground operation to determine C accuracy or other factors. When an INS Navigation Unit is C installed and the L1011 Maintenance Manual Operational Check C is completed, the INS should be turned off by moving the INS C Mode Selector Switch to OFF. Do not operate the INS for C extended periods of ground operation. Further, do not C operate the INS without continued monitoring of the CDU and C MSU in the cockpit.

C B. When maintenance taxiing of the L1011 is required, only the C NO. 1 INS should be aligned to the NAV mode. Before start C of taxiing, assure that:

C (1) No. 1 INS Mode Selector Switch is positioned to NAV and C the NAV READY lamp is light (on). Check using C alternate method on CDU that right, upper display C digits are 1 - - - 55.

C (2) No. 2 and No. 3 INS Mode Selector Switches are C positioned to OFF.

C C. In the event the INS MSU switch is left in ALIGN during C L1011 taxiing, the INS Navigation Unit should not be removed C until the following procedure is accomplished:

C (1) Perform an INS alignment to P1 of 5. A WARN lamp C should appear with malfunction codes 62 and possibly C 60, and 45. If no WARN lamp appears the INS is C serviceable and no further action is required. If the C WARN lamp has lighted, after P1 of 5 is attained, move C MSU switch to STBY.

C (2) Perform a second INS alignment to P1 of 5. A WARN lamp C may appear with malfunctions shown in (a) above. C Follow procedure in (a) above for WARN lamp.

C (3) Perform a third INS alignment to P1 of 5. Follow C procedure in (1) above if WARN does not appear. If the C WARN lamp has lighted, the Navigation Unit is C unserviceable and should be removed from the aircraft.

C D. Action/Malfunction Code Readout - This readout should be C accomplished with the MSU switch in STBY (not ALIGN or NAV). C This procedure will hold the STS display at 0 - - - 95 and C preserve the stored action malfunction codes. Not following C this procedure will cause the INS to proceed to STS 0 - - - C 6X and erase all the malfunction codes (including those that C cleared).

C E. INS Automatic Shutdown - When this occurs during alignment, C it is due either to an over-temperature or an under-voltage. C If the CDU read WARN lamp and the MSU red BAT lamp are C lighted, the INS has shut down because of under-voltage. If C only the CDU red WARN lamp has lighted, the shutdown was C cuased by over-temperature.

C When automatic shutdown occurs from over-temperature and the C equipment cooling system is functioning properly, the INS C navigation unit should be replaced without further attempts C to troubleshoot the system. Not following this procedure C will cause severe damage to the INS platform and C electronics. When automatic shut down occurs due to C under-voltage, the INS battery unit should be replaced.

CR F. Malfunction Code 58 Procedures - This malfunction code will C occur following action code 06 during alignment under the C following conditions:

C (1) Previous flight had position error of more than 3 + 3T C (T = Nav hours of previous flight) nautical miles C (latitude or longitude) from next flight's inserted C position.

C (2) Previous flight had negligible position error but C inserted departure gate tion in error by more than C 3 + 3T (T = Nav hours of previous flight) miles C (latitude or longitude).

C NOTE: Do not replace the INS navigation unit for C malfunction code 58. Clear malfunction code 58 C using the procedure below:

C (a) Set the MSU switch to STBY.

C NOTE: Rotate switch only to STANDBY.

C (b) Place the CDU data selector switch to POS and C insert present position Latitude and Longitude. C WARN light will come on at the completion of C insert.

C (c) DELETED.

C (d) Rotate CDU data selector switch to DSRTK/STS. C Code 06 will show.

C (e) Press TEST switch on CDU. WARN light will go out C and code 06 will clear. Malfunction 58 will show.

C (f) Press TEST switch a second time and malfunction 58 C will clear.

C
C
C
C
C

NOTE: If alignment is stopped or unit shut.down before alignment is completed the malfunction code 58 will be reset and the procedure to clear must be performed again from the beginning to eliminate the code.

C INERTIAL NAVIGATION SYSTEM - FAULT ISOLATION

C 1. General

C The diagrams and schematics in this section can be used for
C fault isolation any time a fault is reported or suspected. The
C PREREQUISITES listed at top of each fault isolation diagram must
C be satisfied prior to starting fault isolation. Uncommon
C abbreviations are defined on using fault code diagram or
C schematic.

C If the flight crew reports a trouble using a FIRM fault code,
C the code can be found in 34 Fault Code Index. The index
C specifies maintenance manual section, fault isolation diagram,
C and block number on diagram where fault isolation procedure
C should start. Schematics are included at end of section to
C supplement fault isolation diagrams or as aid in isolating a
C problem not covered on diagrams.

C Refer to Maintenance Manual Introduction for a more detailed
C discussion of Fault Isolation Reporting Method (FIRM) and use of
C fault isolation diagrams/schematic.

C Since no fault isolation reporting system can cover every
C failure symptom, system functional schematics are provided
C giving information for intercomponent signal tracing from source
C to termination.

C To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
C Cross Reference (WM DIA CROSS REF) table on system functional
C schematics, listing applicable wiring diagram in L-1011 Wiring
C Diagram Manual.

C 2. Supplemental Fault Isolation Data (See Schematics 1 thru 15)

C A. There are two distinct yet related fault isolation
C techniques provided for the INS system.

C The first relates to the malfunction code analysis.
C Malfunction codes identify INS problems detected during INS
C self-test. If a flight crew squawk can be related to a
C specific malfunction code, the malfunction code analysis
C procedure in Paragraph 3 and Figure 103 should be performed.
C After performing this procedure, an operational test should
C be performed.

C If the malfunction code analysis does not clear the trouble,
CR the fault isolation procedure (Figures 103-121) based on an
C operational test, should be accomplished.

C B. The second and more complete method is the fault isolation
CR diagrams, Figures 103 thru 121. This fault isolation
C procedure is a complete procedure, based upon the
C performance of a simplified operational test of the system
C it is presented in a format designed to aid in rapid
C isolation of any failure in the system.

C The test steps making up the simplified test are connected
C by arrows to show the YES, or OK condition path. When all
C of the steps in the YES condition path check out, the system
C is operable. When a test step does not check out, follow
C the NO, or NOT OK line, selecting the box and isolation
C procedure for the trouble symptom listed. After turning to
C the appropriate procedure, continue to follow a single line
C by analyzing the results of each test step until required
C corrective action is determined. After performing
C corrective action, repeat step at which failure was
C encountered and complete simplified operational test
C procedure to check out system.

C C. When all INS are operating properly, slight display
C variations between systems will normally be observed. This
C is caused by such factors as gyro drift rate variations,
C temperature changes, and mechanical friction.

CR Each INS produces an INS Comparator Light output during NAV
C mode when the radial distances between the computer present
C position (inertial+manual fixes) of one INS and the computed
C present position (inertial+manual fixes) of the other two
C INS exceeded a specified distance. This distance is based
C on time of flight and varies linearly from approximately 5
C miles after 1 hour of flight to approximately 43 miles after
C 10 hours of flight. Three FINC lights--INS-1, INS-2, and
C INS-3--are located on the pilots center console. A FINC
C output from No. 1 INS lights the INS-1 light, No. 2 INS

C lights the INS-2 light, etc., indicating that navigation
C accuracy is out of tolerance for that particular INS and the
C flight crew will select another INS for primary navigation.

C During alignment (before NAV READY) a WARN light on the CDU
C and 06 action code may appear with malfunction code 43.
C This indicates that present position inserted on that INS
C disagrees with the other two INS by more than 0.84 nautical
C miles. Present position should be reloaded correctly by
C selecting STBY and reloading.

C D. The operation of the WARN lamp indicates that a critical
C malfunction exists. If the WARN lamp lights during the
C operational test, the malfunction code analysis procedure
C (Para. 3) must be performed. Performing this procedure will
C allow the particular malfunction to be identified and
C corrective action taken. The existence of noncritical
C malfunctions is also noted in the procedure.

C The malfunction code analysis procedure lists the
C malfunction code, pilots action code, and recommended
C maintenance action. After performing the malfunction code
C analysis, the step at which the malfunction was encountered
C should be repeated before completing the simplified
C operational test procedure.

C E. An "inserted position check" is included to prevent
C inserting present position identically yet erroneously on
C all three INS. During alignment, immediately after present
C position is inserted, each INS compares the inserted
C position with the INS position at the last INS shutdown. If
C the latitude or longitude difference exceeds 3+3T
C (T=navigation hours of last flight) nautical miles, the CDU
C WARN lamp lights with action code 06 and malfunction code
C 58. (See action code/malfunction code procedure.) When this
C occurs, move the MSU switch to STBY, and reinsert the
C correct present position twice. Select DSRTK/STS and
C destination code 060 and malfunction code 58 by depressing
C CW test button. DO NOT REPLACE THE NAVIGATION UNIT FOR THIS
C ACTION/MALFUNCTION CODE.

CR F. THE INS ACCURACY REQUIREMENTS (SHOWN BELOW) APPLY TO EACH INS:

CR (1) FIRST TIME ACCURACY LOG WRITE UP:

CR (a) NORTH ATLANTIC (INCLUDING EASTBOUND LAX-LHR AND OTHER FLIGHTS
CR UP TO 10 HOURS. LESS THAN 19.0 NAUTICAL MILES CROSSTRACK (LATITUDE)
CR ERROR AND LESS THAN 3.1 NAUTICAL MILES (RADIAL ERROR) PER HOUR OF
CR FLIGHT.

CR (b) FLIGHTS OVER 10 HOURS (EXCEPT EASTBOUND LAX-LHR). LESS THAN 20
CR NAUTICAL MILES CROSSTRACK (LATITUDE) ERROR AND LESS THAN 25
CR NAUTICAL MILES ALONG TRACK (LONGITUDE) ERROR.

CR (2) SECOND TIME ACCURACY LOG WRITE UP:

CR (a) NORTH ATLANTIC (INCLUDING EASTBOUND LAX-LHR) AND OTHER FLIGHTS
CR UP TO 10 HOURS. LESS THAN 14.2 NAUTICAL MILES CROSSTRACK (LATITUDE)
CR ERROR AND LESS THAN 2.1 NAUTICAL MILES (RADIAL ERRORS) PER HOUR OF
CR FLIGHT.

CR (b) FLIGHTS OVER 10 HOURS (EXCEPT EASTBOUND LAX-LHR). LESS THAN 20
CR NAUTICAL MILES CROSSTRACK (LATITUDE) ERROR AND LESS THAN 25
CR NAUTICAL MILES ALONG TRACK (LONGITUDE) ERROR.

CR (3) WHEN AN INS IS WRITTEN UP IN THE AIRCRAFT LOG AND THE NAVIGATION ERROR IS
CR WITHIN THE ACCURACY REQUIREMENTS SHOWN ABOVE, THE INS SHOULD BE REALIZED
CR TO "PI 5" AND CHECKED FOR NO WARN LIGHT INDICATION ON THE CDU.

CR (4) REPLACE INS NAVIGATION UNIT WHEN ACCURACY REQUIREMENTS ARE EXCEEDED.

CR (5) DETERMINATION OF INS NAVIGATION RADIAL ERROR PER HOUR AND CROSSTRACK
CR (LATITUDE) ERROR CAN BE MADE BY UTILIZING THE INS PERFORMANCE/ACCURACY
CR CHECKSHEET SHOWN BELOW, OR BY PARAGRAPH G AND H PROCEDURES FOLLOWING.

CR (6) INS PERFORMANCE/ACCURACY CHECKSHEET PROCEDURE (REFERENCE FIGURE 100A
CR "EXAMPLE")

CR (a) OBTAIN APPROPRIATE "CHECKSHEET" FOR THE STATION WHERE ACCURACY
CR WRITEUP OCCURRED.

CR NOTE 1: FLIGHT CREW PROCEDURES FOR INS ACCURACY WRITEUPS WILL
CR PROVIDE THE "__NM/HR" CALCULATION RESULT. WHEN IT EXCEEDS
CR 3 NM/HR, A MAINTENANCE LOG WRITEUP WILL BE MADE AND THE
CR "__NM/HR" FOR EACH INS WILL BE MADE ABOVE THE INS DATA
CR BOXES (SEE EXAMPLE CHECKSHEET).

CR NOTE 2: FLIGHT CREW WRITEUPS, SUCH AS, "INS COMPARATOR LIGHT NO. 1
CR INS" OR "MALF CODE 06-56, NO. 1 INS" ARE NOT SATISFACTORY
CR WRITEUPS UNLESS ACCOMPANIED BY THE COMPLETED "__NM/HR"
CR INFORMATION.

CR NOTE 3: COMPLETING THE INS PERFORMANCE/ACCURACY CHECKSHEET IS
CR IMPORTANT ON ALL ACCURACY REMOVALS TO ASSURE THAT A
CR TRUE ACCURACY PROBLEM EXISTS AND TO ASSURE MCI SHOP
CR EXPEDITIOUS UNIT TURN-AROUND.

CR (b) COPY THE AIRCRAFT LOG INS DATA BOX INFORMATION AND "_NM/HR"
CR DATA INTO THE IDENTICAL BOXES ON THE INS PERFORMANCE/ACCURACY
CR CHECKSHEET.

CR (c) INSERT THE AIRCRAFT LOG "FLIGHT/DATE" IN THE BLOCK PROVIDED IN THE
CR CHECKSHEET.

CR (d) INSERT THE AIRCRAFT LOG FLIGHT WRITEUP IN THE "REMARKS" AREA OF THE
CR CHECKSHEET.

CR (e) INSERT THE "INS NBR_(1, 2, OR 3) AND TWA "S/N_" BLOCKS OF THE CHECKSHEET
CR (IF UNIT REMOVED).

NOTE: THE REMAINING STEPS ARE ALL ACCOMPLISHED ON THE "CHECKSHEET".

CR (f) PLOT THE INS LATITUDE AND LONGITUDE (FROM THE CHECKSHEET) ON THE
CR EDGE OF THE GRAPH AND PLACE AN ARROW THERE.

CR (g) EXTEND THESE POINTS TO THE POINT WHERE THEY CROSS AND PLACE A "+"
CR AT THAT POINT. THIS POINT REPRESENTS THE INS POSITION COMPARED TO
CR THE CENTER OF THE CIRCLE WHICH IS THE STATION GATE POSITION.

CR (h) COPY THE "TERM GATE TIME" AND "INS ON TIME" FROM THE DATA BOXES TO
CR THE RIGHT SIDE BLANKS. EXAMPLE: "1938" AND "1220", RESPECTIVELY.

CR (i) SUBTRACT THESE TWO QUANTITIES (STEP (h) ABOVE) AND PLACE DIFFERENCE
CR IN NEXT BOX LABELED "NAV TIME" IN HOURS AND MINUTES. EXAMPLE: 7:18.

CR (j) RECORD LATITUDE ERROR IN THE NEXT BOX. EACH DIVISION OF THE GRAPH
CR EQUALS 1 NAUTICAL MILE. COUNT FROM THE CENTER OF THE CIRCLE (UP OR
CR DOWN) TO THE "+" ON THE GRAPH. EXAMPLE: 16.5

CR (k) RECORD LONGITUDE ERROR IN THE NEXT BOX. USE THE CIRCLES (4, 8, 12,
CR 16, 20, 24 NAUTICAL MILES) TO DETERMINE DISTANCE (LEFT OR RIGHT) FROM
CR CIRCLE CENTER. EXAMPLE: 16.0.

CR (l) RECORD RADIAL ERROR IN THE NEXT BOX. USE THE CIRCLES AND ESTIMATE
CR THE DISTANCE FROM THE CIRCLE CENTER TO THE "+". EXAMPLE: 23.0.

CR (m) PERFORM RADIAL ERROR PER HOUR PROCEDURE IN THE NEXT BOX. TRANSFER
CR THE RADIAL ERROR (23.0) TO "$\sqrt{23.0}$". CONVERT THE HOURS AND MINUTES
CR (7:18) TO HOURS (7.3) AND TRANSFER TO "$7.3\sqrt{23.0}$

CR NOTE: 6 MINUTES EQUALS 0.1 HOURS.

CR (n) COMPLETE THE DIVISION PROBLEM OR USE AN ELECTRONIC CALCULATOR AND
CR PLACE ANSWER (QUOTIENT) ABOVE DIVISION LINE.

CR EXAMPLE: $7.3\overline{)23.0}$ — 3.2 NM/HR

CR (o) COMPARE THE ACTUAL INS ACCURACY (DETERMINED ABOVE) TO THE MAINTENANCE
CR MANUAL INS ACCURACY REQMNTS SHOWN ON THE CHECKSHEET. WHEN THE
CR ACCURACY REQUIREMENTS ARE EXCEEDED, THE INS NAVIGATION UNIT IS
CR TO BE REMOVED.

CR EXAMPLE: LENGTH OF FLIGHT - 7.3 HOURS
CR LATITUDE ERROR - 16.5 NAUTICAL MILES (NM)
CR LONGITUDE ERROR - 16.0 NM
CR RADIAL ERROR PER HOUR - 3.2 NM/HOUR

CR ASSUME FIRST ACCURACY SQUAWK LESS THAN 10 HOURS —
CR 16.5 NM DOES NOT EXCEED THE 19.0 NM LATITUDE LIMIT
CR 3.2 NM/HR DOES EXCEED THE 3.1 NM/HR RADIAL ERROR PER HOUR
CR LIMIT
CR CONCLUSION: INS NAVIGATION UNIT SHOULD BE REPLACED AND
CR CHECKSHEET SHOULD BE SENT TO MCI ELECTRONIC
CR ENGINEERING, ROOM 1-470.

INS PERFORMANCE / ACCURACY CHECKSHEET (COPY LOG BOOK INS DATA)

INERTIAL SYSTEM NO 1 3.2 NM/HR NO 2 1.6 NM/HR NO 3 1.2 NM/HR

ROUTE	PLANE NUMBER	TERM STA	FLT NO	INS NO 1 LATITUDE	N/S	INS NO 2 LATITUDE	N/S	INS NO 3 LATITUDE	N/S
NAV DATA	31025	JFK	UA540	5505	N	4042	W	4035	N
INS ON (Point GI)	TERM STA TIME (GI)	INS NO 1 LONGITUDE	E/W	INS NO 2 LONGITUDE	E/W	INS NO 3 LONGITUDE	E/W		
1220	1938	07326	W	07352	W	7325	W		

FLT DATE 9 01 20

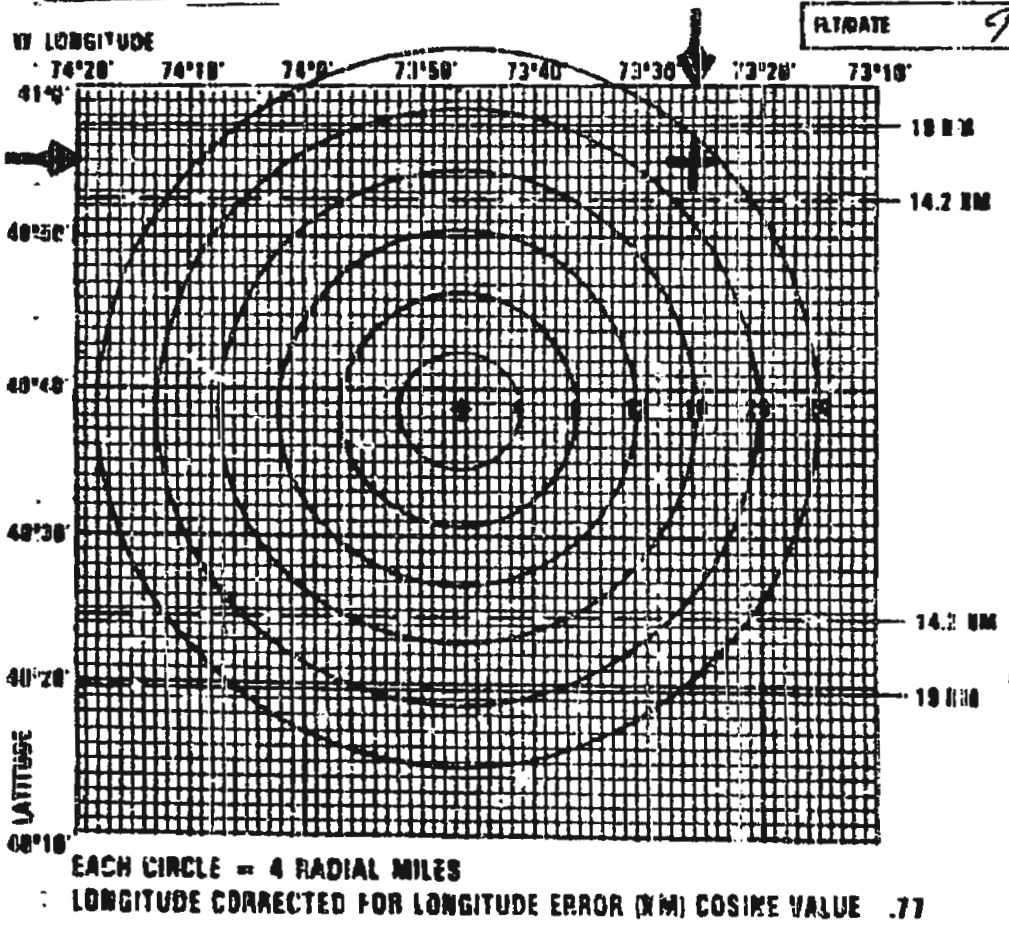
FOR USE ONLY
JFK TERMINAL

TWA GATE POSITION
N40°38.7' W73°46.6'

SEND TO EDGR'S 1-678 MCI

Complete this form for all Flight Sights and use of Tolerance Accuracy Reports. Use separate form for each exit. Plot INS position vs. station gate position.

REMARKS: INS NO. 1 HAD 3.2 NM/HR ERROR AT MC 06-56. REPLACED #1 INU. EXCEEDS SPEC.



EACH CIRCLE = 4 RADIAL MILES

LONGITUDE CORRECTED FOR LONGITUDE ERROR (NM) COSINE VALUE .77

FOR INS NBR: 1 S/N 25

TERM GATE TIME (Z) FROM NAVCAT DATA	1936
INS ON TIME (Z) FROM NAVCAT DATA	1220
SUBTRACT TO OBTAIN NAV TIME	7:18 HR

INS ACCURACY DETERMINATION

LATITUDE ERROR	16.3	NM FROM CHART
LONGITUDE ERROR	18.8	NM FROM CHART
RADIAL ERROR	23.0	NM FROM CHART

RADIAL ERROR PER HOUR PROCEDURE

RADIAL ERROR PER HOUR = RADIAL ERROR (NM) / NAV TIME (HRS)

3.2 NM/HR

7.3 HR) 23.0 NM RAD ERROR MECH

MAINTENANCE MANUAL INS ACCURACY REQMNTS

FIRST ACCURACY CHECK (NOTE FLT HOURS)

1. FLTS LESS THAN 10 HOURS (EXCLUDING E/B POLAR): LESS THAN 19 NM LATITUDE ERROR AND LESS THAN 3.1 NM RADIAL ERROR PER HOUR
2. FLTS OVER 10 HOURS (EXCEPT E/B POLAR): LESS THAN 20 NM LATITUDE ERROR AND LESS THAN 25 NM LONGITUDE ERROR

SECOND ACCURACY CHECK (NOTE FLT HOURS)

1. FLTS LESS THAN 10 HOURS (EXCLUDING E/B POLAR): LESS THAN 14.2 NM LATITUDE ERROR AND LESS THAN 2.1 NM RADIAL ERROR PER HOUR
2. FLTS OVER 10 HRS (EXCEPT E/B POLAR): LESS THAN 28 NM LATITUDE ERROR AND LESS THAN 25 NM LONGITUDE ERROR

M1--0000--34--4068

INS PERFORMANCE/ACCURACY CHECK SHEET
Figure 100A

EFFECTIVITY: INS EQUIPPED AIRCRAFT

CR
CR

006B

C G. "Radial Error Per Hour" Calculation Procedure

C Use this procedure for INS calculation of the radial error
C (hypotenuse of latitude and longitude errors) per hour of
C INS navigation: (See Fig. 122).

C (1) Place INS MSU switch to STBY and observe that "0" is
C displayed on FROM/TO display.

C (2) Place CDU data selector to WAYPT.

C (3) Place CDU waypoint thumbwheel selector to "1".

C (4) Insert actual station positioned (latitude and
C longitude) in waypoint "1". (Refer L-1011 M/M Chapter
C 34-43-00, Page 507)

C (5) Place CDU data selector to DIS/TIME and read DIS
C (radial) display.

C (6) Compute radial error per hour by dividing DIS (radial)
C display (nautical miles) by time (hours) of the last
C flight.

CR NOTE: See Figure 100B, Example 1.

C H. "Cross Track (Latitude) Error Calculation Procedure

C Use this procedure for calculation of crosstrack (latitude)
C error at end of flight:

C (1) Determine actual station latitude. Refer to
C Maintenance Manual. (Chapter/Section 34-43-00, Page
C 507).

C (2) Record INS arrival gate latitude from the aircraft log
C for the particular INS squawked:

C Example:

C JFK latitude readout N40°31.6'

C (3) Find the latitude difference between the JFK terminal
C and the INS readout:

CR NOTE: See Figure 100B, Example 2.

C (4) Since one (1) minute of latitude error equals one (1)
C nautical mile, 7.1 minutes equals 7.1 nautical miles
C latitude error (crosstrack).

7.1 minutes
latitude = 7.1 nautical miles crosstrack error
error

I. INS Ground Speed Malfunction Criteria - INS ground speed (GS) readout on CDU at the departure gate after NAV READY mode is reached is a good check of future INS accuracy for the remainder of the flight.

(1) INS Ground Speed (GS) at Departure Gate

(a) INS ground speed reading at the departure gate with the NAV READY light illuminated (MSU switch in NAV) and stationary aircraft should remain within the following limits:

Time in NAV READY Mode	INS GS Reading
0 - 1/2 Hr	0 Knots
1/2 - 2 Hrs	0 - 5 Knots

NOTE: After two (2) hours of INS operation in NAV READY mode at departure gate, INS should be switched to STBY and realigned to NAV READY mode before departure.

RADIAL ERROR PER HOUR = $\frac{\text{DIS (NAUTICAL MILES) RADIAL ERROR}}{\text{TIME (HOURS) OF LAST FLIGHT}}$

RADIAL HOUR COMPUTATION
EXAMPLE 1

N40°38.7' (JFK TERMINAL)
N40°31.6'
7.1' LATITUDE DIFFERENCE (MINUTES)

LATITUDE DIFFERENCE BETWEEN JFK TERMINAL AND INS READOUT
EXAMPLE 2

M1-0001-34-3407

CR CR Examples 1 and 2
Figure 106B

(2) INS Ground Speed (GS) at Arrival Gate

(a) INS ground speed reading at the arrival gate (with stationary aircraft and INS MSU still in NAV READY mode) is an indication of INS performance, but the position accuracy check takes precedence.

NOTE: At arrival gate, flight crew must be advised by radio to leave MSU in NAV READY mode to read INS ground speed (GS) on incoming flights.

(b) INS ground speed reading at arrival gate with MSU still in NAV READY mode should remain within the following limits:

Time in NAV READY Mode	INS GS reading
0 - 10 Hrs	0 - 8 Knots
10 - 15 Hrs	0 - 12 Knots

J. INS Wind Display Malfunction Criteria

(1) The INS Wind Display accuracy is dependent on many factors including the CADC TAS output accuracy (CADC No. 1 to INS No. 1, CADC No. 2 to INS No. 2 and INS No. 3), actual wind magnitude (knots) and INS ground speed accuracy. When actual wind magnitude is below 3 knots, the wind direction cannot be determined by the INS.

(2) The following INS Wind Display Criteria should be used to determine normal operation (assumes TAS input normal):

(a) Wind Speed - The displayed difference between any two INS shall be less than 24 knots.

- Individual INS display inaccuracy shall be less than 12 knots.

(b) Wind Direction - The displayed difference between any two INS's shall be less than 20 degreeswhen actual wind speed is greater than 25 knots.

- Individual INS display inaccuracy shall be less than 10 degrees when actual wind speed is greater than 25 knots.

- Individual INS display inaccuracy shall be less than 90 degrees when actual wind speed is between 3 and 25 knots.

C - The display difference between any two INS's can
C be up to 180 degrees when actual wind speed is
C less than 3 knots.

C K. The operation of the WARN lamp indicates that a critical
C malfunction exists. If the WARN lamp lights during the
C operational test, the malfunction mode analysis procedure
C (paragraph 3) must be performed. Performing this procedure
C will allow the particular malfunction to be identified and
C corrective action taken. The existence of noncritical
C malfunctions is also noted in the procedure. The
C malfunction code analysis procedure lists the malfunction
C code, pilots action code, and recommended maintenance
C action. After performing the malfunction code analysis, the
C step at which the malfunction was encountered should be
C repeated before completing the simplified operational test
C procedure.

C 3. Trouble Shooting Tips

C A. Trouble shooting of the INS is facilitated by inherent
C self-testing features of the system which provide one or
C more warning indications when a failure occurs.

C The WARN lamp on control display unit (CDU) provides a
C master warning for most malfunctions occurring in navigation
C unit (NU). Malfunctions occurring in mode select unit (MSU)
C or CDU are not indicated by malfunction codes but will
C normally be obvious because of abnormal indications on
C displays and lamps.

C In general, an abnormal display accompanied by a WARN light
C indicates a NU malfunction; an abnormal display not
C accompanied by a WARN light indicates a CDU malfunction. A
C battery unit malfunction will cause the INS to automatically
C shut down if the INS is operating on battery power. When
C this happens, the WARN light on CDU and BAT light on MSU
C will come on.

C In addition to visual indications on CDU and MSU, the INS
C produces separate output voltages to other aircraft systems
C to indicate true heading, navigation, primary pitch and roll
C attitude, auxiliary pitch and roll attitude, and platform
C heading output signals from each INS are valid. These
C outputs operate flags and interlocks external to the INS
C unit, but a short or open circuit can render the affected
C output inoperative.

C When fault isolating a flag or interlock problem, consider
C the possibility that connectors or relays in the circuit may

C be at fault, and switching to alternate systems may also
C render the newly selected units inoperative.

C NOTE: If WARN light on CDU and BAT light on MSU come on
C during a predeparture check, delay may be averted or
C minimized by switching system OFF and then to NAV.
C Battery may then be replaced while system is
C aligning. Check replacement battery by momentarily
C opening INS PWR circuit breakers and osberving that
C BAT light comes on.

C B. The INS battery unit provides a power interlock circuit and
C the INS cannot be turned on unless appropriate battery unit
C is in place and battery unit circuit breaker is closed.

C C. An overtemperature in the NU will cause an INS to
C automatically shut down when the mode selector is at STBY or
C ALIGN during ground operation. The WARN lamp on the CDU
C will illuminate and will not extinguish until the mode
C selector is rotated to OFF. The operation of the FWD
C AVIONICS fan and INS fan should be checked as well as the
C integrity of the gaskets (air flow seals) on the NU mounting
C trays. The NU should be replaced if this overtemperature
C failure persists. Replacement of the FWD AVIONICS fan
C should be considered for INS overheat indications due to fan
C underspeed.

C D. Remote Data Loading Problems

C (1) The trouble shooting tree is based on the operation of
C one INS and, therefore, does not include a check of the
C remote data loading and displaying functions. Each INS
C system is completely separate except for remote loading
C and display of data, and trouble analysis of one system
C prevents interference with an operating INS.

C If a problem concerns remote data loading, first
C determine that all three INS are operating by loading
C and displaying data on each INS separately. With all
C three INS in the REMOTE mode, enter data through one
C CDU into the other INS. If the data does not load (or
C loads incorrectly) repeat loading process two or three
C times and/or use a different INS to do the loading.
C Also recycle system through OFF to restart computer
C timing which may have been out of synchronism with
C other systems. If each INS will accept the data at
C least once, no component change is necessary.

C (2) The navigation unit of an INS should be replaced only
C if the system can be shown to consistently either not
C accept or not transmit data. The solution for a system

C that intermittently rejects or alters data is to enter
C it several times.

C 4. Significance of Action/Malfunction Codes

C A. In order to ensure dispatchability and prevent unnecessary
C component removals, a knowledge is required of the causes of
C some malfunction codes or what these codes will do to the
C operation of the system.

C B. Loss of Attitude Valid will cause the ADI to shut down with
C the warning flag in view and the tape tumbling. Any of the
C malfunctions 33 through 39 will cause a loss of the Attitude
C Valid signal from the INS. If any of these malfunctions do
C not appear in Temporary or Semipermanent Malfunction Record
C then the problem should not be the INS nav unit.

C C. Malfunctions42, 45, or 60, when appearing in either this
C entire group or several appearing together would indicate
C that the system was moved or taxied in ALIGN. Under extreme
C conditions, malfunction 15may appear, but again this would
C be along with several of the others. A realignment will
C normally correct these codes. However, if NAV was selected
C with these malfunctions present, it may take several
C alignments (and going to NAV each time) to cure them.

C D. Malfunctions 32, 59 and 63, are computer self-check
C malfunctions. In order to verify the existence of any other
C problem, it is necessary to align the system to at least
C PI=8. The computer is at idle during PI=9 (or STBY) and
C will detect only computer malfunctions. Until PI=8 the only
C other things that can be seen are the stored malfunctions
C from the last time the system was operating. These can be
C extinguished with the Push to Test and if they were hard
C failures, will not reappear until the computer goes into
C full operation (PI=8).

C E. Malfunctions 43 and 45 are checks of the present position
C that is loaded into the system. Code 45 is an absolute
C check of loaded versus calculated latitude and 43 is a
C relative check of loaded latitude and longitude between the
C systems.

C Malfunction 45 will occur 5 minutes after entering PI=6 if
C the difference between loaded and calculated latitude is
C greater than 42 minutes. If either of these malfunctions
C appear, the first thing to check would be loaded latitude.
C If it is correct, then it is possible that the INS
C navigation unit is not calculating latitude correctly.
C However, if this happens on all of the systems then it is
C more probably an incorrect latitude that has been inserted.

C Malfunction 43 occurs when the loaded latitude or longitude
C in any of the system differs by more than 0.84 minutes.

C 5. Action Code/Malfunction Code Display ProcedureFigure 103 (Sheets
C 1 and 2)

C A. Current Malfunctions

C (1) The digital computer unit (DCU) performs data
C reasonableness check and self-tests while monitoring
C warning signals from the IRU and IRUE. The DCU also
C produces pilot action codes and malfunction codes and
C illuminates the WARN lamp on the control/display unit
C (CDU) when malfunctions and out-of-tolerance conditions
C are detected. The digital computer unit records the
C codes, even if the malfunction is momentary, for
C display on the CDU. The following steps describe the
C procedure for interrogating the CDU to determine the
C cause of the warning. It may be possible to correct
C one class of malfunctions (those associated with action
C Codes 04 and 05)by following the recommended
C maintenance action. Figure 103 describes all possible
C action and malfunction codes.

C (a) Place data selector switch in DSRTK/STS position.
C Observe mode status/actual performance index
C number, desired performance index number, and
C pilots action code in right data display. (See
C Fig. 103.)

C (b) Press and release TEST switch. Observe that
C action code display (13 through 63).

C NOTE: If WARN lamp goes out, failure was
C intermittent and has been cleared. If
C cleared, disregard the action code.

C (c) Repeat Step (b) recording each malfunction code
C displayed until display goes blank or until the
C action code reappears. Perform action for most
C severe malfunction recorded.

C B. Semi-permanent Malfunction Record Display

C (1) Codes for all malfunctions and out-of-tolerance
C conditions detected by the DCU are semi-permanently
C recorded for display as they occur. The DCU erases
C this record and starts a new record each time fine
C alignment (PI=6) is started. The following steps
C describe the procedure for interrogating the DCU to
C display codes for all malfunctions, including

C intermittent out-of-tolerance conditions, which have
C been detected by the DCU since the last time fine
C alignment was started.

C CAUTION: THE MSU MODE SELECT SWITCH SHOULD BE IN STBY
C WHEN DISPLAYING THE SEMI-PERMANENT
C MALFUNCTION RECORD; OTHERWISE, FINE ALIGNMENT
C OF THE SYSTEM WILL TAKE PLACE AND ERASE THE
C MEMORY.

C (a) Place data selector switch in DSRTK/STS position.
C Observe actual performance index number and
C desired performance index number in right data
C display.

C (b) Simultaneously press and hold TEST switch and HOLD
C key. Observe all eight in data displays and
C FROM-TO display and all lamps and keys lighted.

C (c) Release TEST switch and HOLD key. Observe that
C malfunction code (13 through 63) appears in right
C data display.

C (d) Press and release TEST switch in sequence and
C record all malfunction codes until malfunction
C code display goes blank or reverts to an action
C code display (01 through 04 and 06). Refer to
C Figure 103 (Sheet 2) for recommended action.

C NOTE: The semi-permanent malfunction record
C display can be repeated by rotating the DSS
C out of the DSRTK/STS position, then back
C into DSRTK/STS and repeating Steps (b)
C through (d).

C (e) If entry to the malfunction code analysis
C procedure was from a flight squawk, perform an
C operational test. If entry was from the trouble
C tree, repeat the step at which the malfunction
C occurred and complete the remaining steps on the
C trouble tree.

C 6. Prepare for Fault Isolation

C A. Set mode selector switch on each mode selector unit (pilots
C overhead panel P5) to OFF position.

C B. Provide electrical power (Ref. 24-00-00, Maintenance
C Practices).

C. Provide cooling air to INS equipment (Ref. 21-25-00, Adjustment/Test).

CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF NAVIGATION UNITS.

D. Close all INS, ADI, ATT and WINDSHIELD WASHER circuit breakers on circuit breaker panels P6, P8 and P10.

C 7. Fault Isolation Identification

C Table 101 lists the fault isolation diagrams and schematics in
C this section. Figures 101 and 102 provide Inertial Navigation
C System and associated component locations.

C Fault Isolation Diagrams and Schematics List
C Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103 (Sheet 1 and 2)	Status/Malfunction Code Display
104	Circuit Breakers Trip And Cannot Be Reset
105	System and/or System Source HSI Annunciations Do Not Annunciate Properly
106	Panel Lighting Will Not Illuminate, or Will Not Adjust
107	System Malfunction With Mode Selector Set To Standby Position
108	Malfunction During CDU BAT-MSU BAT Light Check
109	Malfunction Encountered While Loading and Displaying Performance Index
110	Malfunction Encountered During Lamp Test
111	Noncritical Malfunction Codes Are Displayed On CDU
112	System Fails BAT Test or PI Does Not Change
113	Attitude Tape In ADI Will Not Come to Level
114	Data Display Intensity Will Not Adjust or Appears Blank
115	Warn Lamp On CDU Illuminates Anytime During Troubleshooting Test Procedure
116	Malfunction Encountered While Loading Present Position Coordinates
117	HSI Presentation Incorrect With Test Switch Held Down

C Fault Isolation Diagrams and Schematics List (Cont)
C Table 101

FIGURE	TITLE
118	Malfunction Encountered While Loading And Displaying Waypoint Positions
119	READY NAV Lamp Does Not Illuminate Within Reasonable Time Period
120	Malfunction Encountered When System Operating in NAV Mode - NAV Data Erratic
119	
121	INS System Faults (general)
122	Radial Error Per Hour Calibration Procedure
NOTE:	SCHEMS 1 thru 15 apply to INS EQUIPPED AIRCRAFT THRU 031.
SCHEM 1	Inertial Navigation System Intercabling Schematics
SCHEM 2	No. 1, No. 2 and No. 3 INS Power and Attitude Excitation
SCHEM 3	ADI Power; ATT ALTN and Radio/INS Select
SCHEM 4	No. 1 and No. 2 INS Attitude Outputs
SCHEM 5	No. 3 INS Attitude Outputs
SCHEM 6	No. 1 INS Air Data, Inputs and CDU/MSU Connections
SCHEM 7	INS No. 1 ATT and NAV Outputs
SCHEM 8	INS No. 2 and No. 3 Air Data Inputs and Nav Outputs
SCHEM 9	No 3 INS CDU/MSU; No. 1, No. 2 and No. 3 INS Comparison
SCHEM 10	Capt and F/O ADI; Mag Hdg and Course Select
SCHEM 11	ALTN Mag Hdg Select and Switching
SCHEM 12	RNAV (INS) ALTN and Radio/INS Switching
SCHEM 13	Capt HSI, HDG and ATT Instr Warn Display
SCHEM 14	VG3 Lt; Instr Cmprsn Mon; No. 2 INS CDU/MSU

Fault Isolation Diagrams and Schematics List (Cont)
Table 101

FIGURE	TITLE
SCHEM 15	INS Interface Unit
NOTE:	SCHEM 1 (Sheets 1, 2 and 3) and SCHEM 2 (Sheets 1, 2, 3 and 4) apply to aircraft 032-999.
SCHEM 1 (Sheet 1)	INS Schematic (Pwr and Excit)
SCHEM 1 (Sheet 2)	INS Schematic (No. 1 and No. 2 ATT Outputs)
SCHEM 1 (Sheet 3)	INS Schematic (No. 3 Attitude Outputs)
SCHEM 2 (Sheet 1)	INS Schematic (Air Data Inputs - CDU/MSU Conn)
SCHEM 2 (Sheet 2)	INS Schematic (INS-1 Output Interface)
SCHEM 2 (Sheet 3)	INS Schematic (INS-2 Output Interface)
SCHEM 2 (Sheet 4)	INS Schematic (INS-3 Interface)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
INDICATOR – HORIZONTAL SITUATION	2	FLT STA; CAPT AND F/O INSTR PNL	34-55-04
LIGHT – FINC	3	FLT STA; CTR CSL	20-33-04
SWITCHLIGHT – RADIO/INS	2	FLT STA; CTR CSL	20-31-03
TRANSFORMER – IMU EXCITATION	3	FESC; FWD RACK; 112AB	34-43-08
UNIT – BATTERY	3	FESC; DIR GYRO RACK; 112AB	34-43-05
UNIT – CONTROL DISPLAY	3	FLT STA; CTR CSL	34-43-02
UNIT – INERTIAL NAVIGATION	3	FESC; FWD RACK; 112AB	34-43-03
UNIT – MODE SELECTOR	3	FLT STA; PILOTS OVHD PNL	34-43-01

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C
C

Component Location Index
Figure 101

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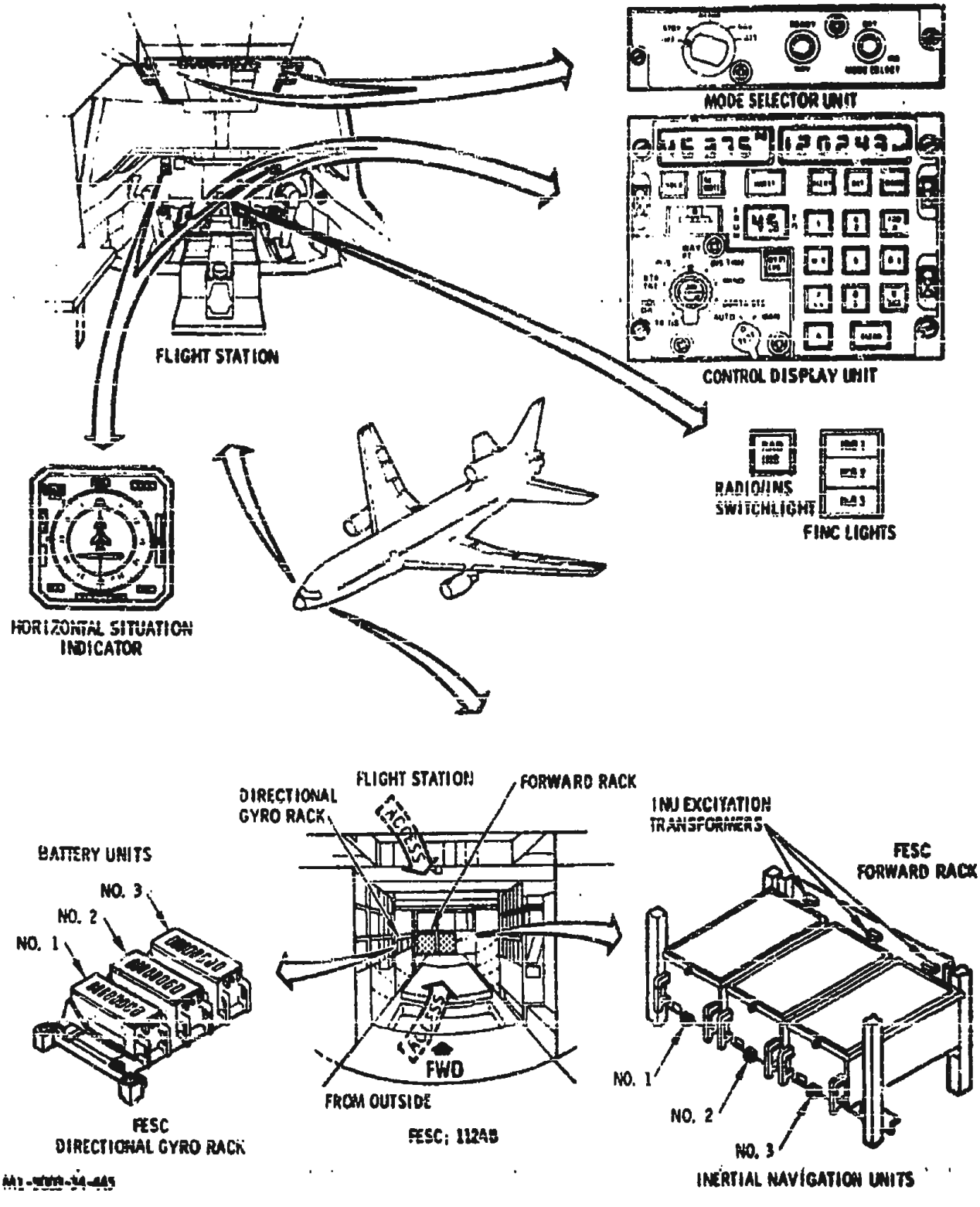
EFFECTIVITY: INS EQUIPPED AIRCRAFT



C
C Component Locator Diagram
Figure 102

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
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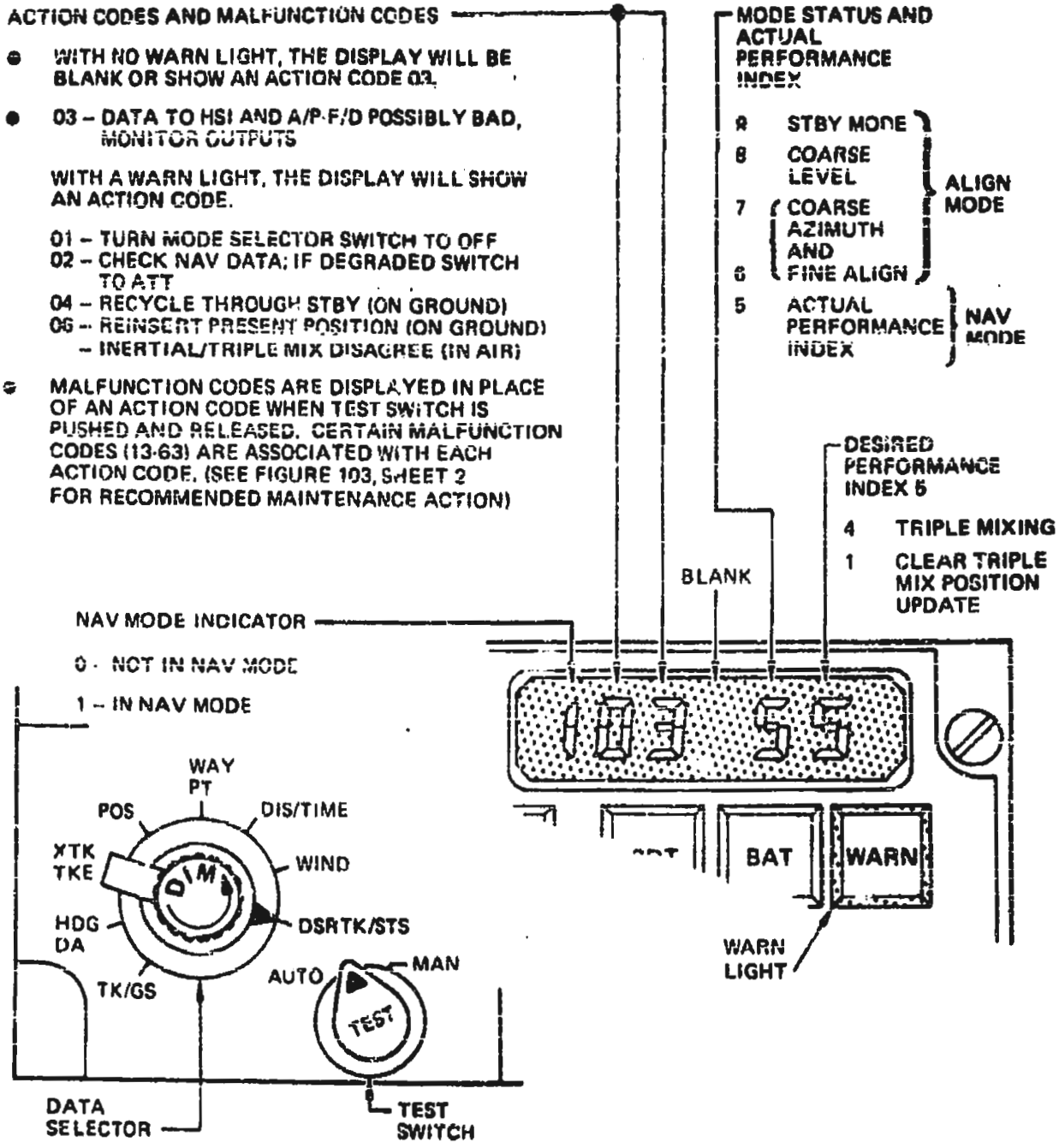
ACTION CODES AND MALFUNCTION CODES
WITH NO WARN LIGHT, THE DISPLAY WILL BE BLANK OR SHOW AN ACTION CODE 03.
03 – DATA TO HSI AND A/P-F/D POSSIBLY BAD, MONITOR OUTPUTS
WITH A WARN LIGHT, THE DISPLAY WILL SHOW AN ACTION CODE.
01 – TURN MODE SELECTOR SWITCH TO OFF
02 – CHECK NAV DATA; IF DEGRADED SWITCH TO ATT
04 – RECYCLE THROUGH STBY (ON GROUND)
05 – REINSERT PRESENT POSITION (ON GROUND)
– INERTIAL/TRIPLE MIX DISAGREE (IN AIR)
MALFUNCTION CODES ARE DISPLAYED IN PLACE OF AN ACTION CODE WHEN TEST SWITCH IS PUSHED AND RELEASED. CERTAIN MALFUNCTION CODES (13-63) ARE ASSOCIATED WITH EACH ACTION CODE. (SEE FIGURE 103, SHEET 2 FOR RECOMMENDED MAINTENANCE ACTION)
MODE STATUS AND ACTUAL PERFORMANCE INDEX
8 STBY MODE
8 COARSE LEVEL
7 COARSE AZIMUTH AND
6 FINE ALIGN
ALIGN MODE
5 ACTUAL PERFORMANCE INDEX
NAV MODE
DESIRED PERFORMANCE INDEX 5
4 TRIPLE MIXING
1 CLEAR TRIPLE MIX POSITION UPDATE
BLANK
NAV MODE INDICATOR
0 - NOT IN NAV MODE
1 – IN NAV MODE
WAY PT
POS
DIS/TIME
XTK TKE
WIND
HDG DA
DSRTK/STS
TK/GS
AUTO
MAN
TEST
DIM
BAT
WARN
WARN LIGHT
DATA SELECTOR
TEST SWITCH

MI-0000-34-4067

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INS Action/Malfunction Code Display
Figure 103 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

006B

CODE ACTION-MALF	MALF DESCRIPTION	RECOMMENDED ACTION FOR MAINTENANCE
01-33	AZIMUTH STAB LOOP FAIL	REPLACE NU IF ONE OF THESE LOOP MALFS OCCURRED AND HAS NOT BEEN RESET. IF 01 CODE PRESENT, REPLACE NU. IF INS SHUTDOWN IN FLIGHT, REPLACE NU. NOTE: THESE WILL ASLO CAUSE ATTITUDE FLAG IN ADI
01-34	INNER ROLL STAB LOOP FAIL	
01-35	PITCH STAB LOOP FAIL	
01-36	ACCELEROMETER LOOP FAIL	
01-37	Z PLATFORM OVERTEMP	CHECK THAT FWD AVIONICS FAN IS OPERATIVE AND BLADES ARE CLEAN. IF BLADES ARE DIRTY, CHANGE FAN, CLEAN INS BLOWER AND BLOWER CHECK VALVE IF DIRTY. PERFORM INS AIRFLOW CHECK, IF OK, REPLACE NU. NOTE: THESE WILL ALSO CAUSE ATTITUDE FLAG IN ADI.
01-38	XY PLATFORM OVERTEMP	
01-39	OVEN OVERTEMP	
02-22	MEMORY PARITY ERROR	REPLACE NU IF ONE OF THESE COMPUTER MALF OCCURS AND CANNOT BE RESET, (UNIT OK FOR ATTITUDE ONLY)
02-59	600 MSEC LOOP FAIL	
02-63	COMPUTER SELF TEST FAIL	
02-13	ΔV VELOCITY – NAV MODE	1. ALIGN TO MODE 5 AND ENTER NAV; MONITOR FOR MALFS.
02-14	ΔX VELOCITY – NAV MODE	2. IF NO MALFS OCCUR, INS IS GOOD.
02-15	X OR Y GYRO TORQUE TOO HIGH – ALIGN, NAV MODE	3. IF MC 42, 45 OR 60 OCCURS, SET MODE SELECTOR TO STBY AND THEN REALIGN TO MODE 5. IF MC 42, 45 OR 60 REOCCURS, REPLACE NU.
04-18	IN MODE 8 >6.8 MIN.	
02-31	GROUND SPEED > 899 KNOTS	4. IF MALFS OTHER THAN 42, 45 OR 60 OCCUR, REPLACE NU.
02-42	DRIFT ANGLE > 45°	(THESE WILL ALSO CAUSE HSI NAV AND THDS FLAG AND DIGITAL DATA FLAGS.)
04-45	CHANGE IN GYRO SCALL FACTOR TOO LARGE OR WRONG LAT WAS LOADED	NOTE: MALF 57 AN. 82 INDICATES POSSIBLE INS PLATFORM TUMBLING AND ADI ATTITUDE DISPLAY MALFUNCTION.
02-50	VERT. ACCEL. TOO LARGE	
04-57	GIMBAL ANGLE RATE TOO LARGE IN ALIGN MODE	
04-60	ΔWSH TOO LARGE IN ALIGN MODE	
02-62	GIMBAL ANGLE RATE TOO LARGE IN NAV MODE	
03-22*	TKE + DA TO HSI FAIL	1. IF 22, 23, 24, 25 ALL APPEAR, PROBLEM IS USUALLY LOSS OF AIRCRAFT 26VAC. CHECK VG/INS (1, 2, OR 3) CIRCUIT BREAKERS AND INSTR TRANSFORMERS.
03-23*	DA TO A/P FAIL	
03-24*	STEERING TO A/P FAIL	
03-25*	TRUE HDG TO HSI FAIL	
03-26*	XTK TO HSI FAIL	2. IF ONE OR TWO CODES APPEAR AND CANNOT BE CLEARED, REPLACE NU (NU OK FOR NAV AND ATTITUDE, BUT HSI DATA AND AUTOPILOT DATA INVALID).
	*NO CDU WARN LITE	

NOTE REF. MEDP MANUAL ITEM 34-43-00 FOR PROPER PROCEDURES FOR MOVING NR1 OR NR2 INS NAV UNITS TO NR3 POSITION FOR FLIGHT VERIFICATION M1-0001-34-4072

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INS Action/Malfunction Code Display
Figure 103 (Sheet 2)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

006B

CODE ACTION-MALF	MALF DESCRIPTION [1]	RECOMMENDED ACTION FOR MAINTENANCE
06-43	LOADED PRESENT POSITION BETWEEN ANOTHER INS DIFFER >0.8 NMI. IN ALIGN MODE	1. CHECK LOADED PRESENT POSITION. 2. IF REQUIRED, DOWNMODE TO STBY AND RELOAD. 3. CLEAR MALF – UNIT OK (ADVISORY ONLY), DO NOT REPLACE NU.
06-56	TRIPLE MIX POSITION DISPLAY DISAGREES WITH INERTIAL POSITION BY >3 + 3T NM (T = HOURS IN NAV MODE) OR INFLIGHT POSITION UPDATE DISAGREES WITH INERTIAL POSITION BY >3 + 3T NM NOTE: WILL NORMALLY ALSO CAUSE INS COMPARATOR LIGHT	1. CHECK INERTIAL POSITION FOR ACCURACY FOR MAINT MANUAL ACCURACY SPEC AND COMPLETE INS PERFORMANCE/ACCURACY CHECKSHEET. 2. IF WITHIN ACCURACY SPECS, ALIGN TO MODE 5 AND CHECK FOR CDU WARN AND MALFUNCTIONS. 3. IF OUTSIDE ACCURACY SPECS, REPLACE NU.
06-58	INSERTED POSITION DURING ALIGN MODE DISAGREES WITH SHUTDOWN POSITION BY >3 + 3T NM (T = HOURS IN NAV MODE).	1. RECYCLES TO STBY. REINSERT PRESENT POSITION. 2. SELECT DSRTK/STS AND PRESS TEST UNTIL MALF CODE 58 CLEARS. 3. SELECT MSU TO NAV AND COMPLETE ALIGNMENT TO NAV READY. NOTE: DO NOT REPLACE NU FOR THIS MALF CODE UNLESS SHUTDOWN POSITION EXCEEDS MAINT MANUAL ACCURACY SPECS.

[1] "TWA–31N -A1" COMPARATOR PROGRAM (CDU READOUT 63–20)

NOTE REF. MEDP MANUAL ITEM 34-43-00 FOR PROPER PROCEDURES FOR MOVING NR1 OR NR2 INS NAV UNITS TO NR3 FOR FLIGHT VERIFICATION.

ACTION MALFUNCTION CODE READOUT/CLEARING PROCEDURE (REF. FIGURE 103, SHEET 1)

1. SELECT DSRTK/STS ON CDU
2. READ UPPER RIGHT DISPLAY DIGITS YY (XYYXXX) X = DON'T CARE
3. DIGITS YY ARE THE HIGHEST PRIORITY ACTION CODE (OY). REFER TO FIGURE 103 (SHEET 1) FOR ACTION CODE MEANING.
4. PRESS AND HOLD TEST SWITCH ON CDU UNTIL ALL LIGHTS TEST
5. RELEASE TEST SWITCH.
6. READ DIGITS YY. THESE ARE THE MALFUNCTION CODES
7. PERFORM STEPS 4, 5 AND 6 UNTIL ACTION CODE (OY) REAPPEARS, IN ANY.
8. PERFORM STEPS 4, 5 AND 6 AND RECORD MALFUNCTION CODES, IF ANY.

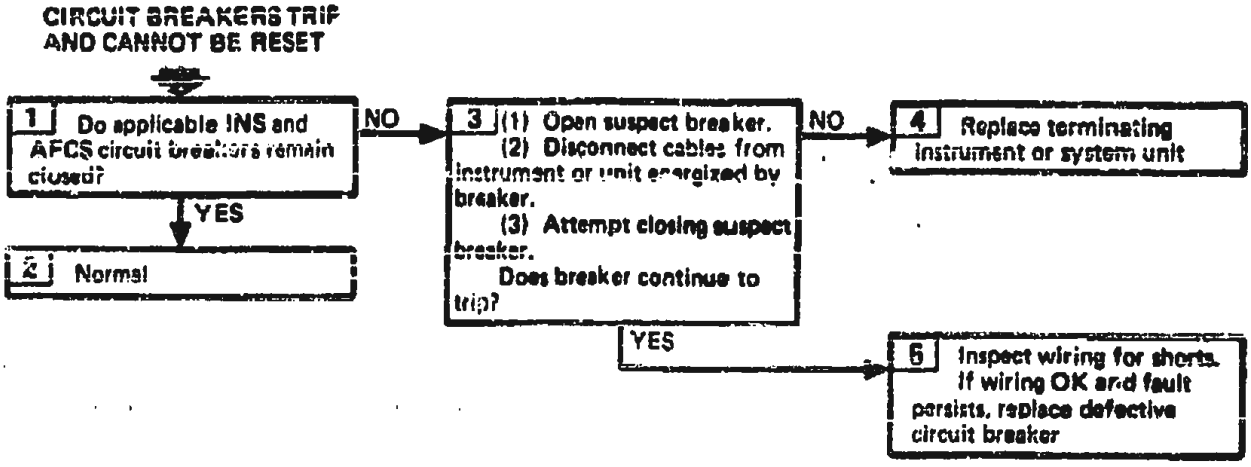
NOTE: IF WARN LIGHT GOES OUT, FAILURE WAS INTERMITTENT AND HAS BEEN RESET (CLEARED). IF RESET, DISREGARD THE CODES.

M1-0001-34-4073

CR INS Action/Malfunction Code Display
CR Figure 103 (Sheet 3)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

006B


CIRCUIT BREAKERS TRIP AND CANNOT BE RESET
1 Do applicable INS and AFCS circuit breakers remain closed?
NO
YES
2 Normal
3 (1) Open suspect breaker.
(2) Disconnect cables from instrument or unit energized by breaker.
(3) Attempt closing suspect breaker.
Does breaker continue to trip?
NO
YES
4 Replace terminating instrument or system unit
5 Inspect wiring for shorts. If wiring OK and fault persists, replace defective circuit breaker

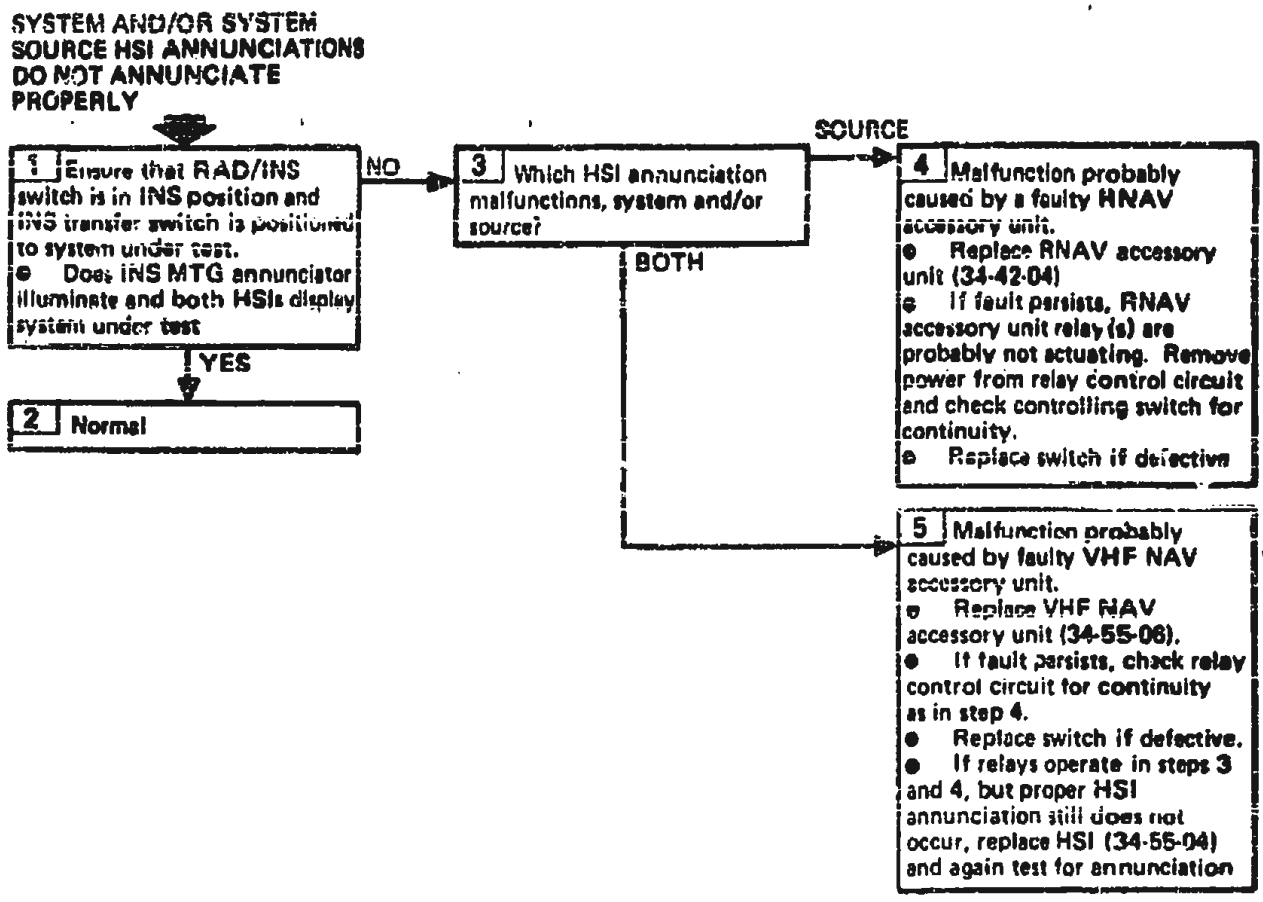
NOTE
Prepare for troubleshooting as described in paragraph 5

PREREQUISITES
Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-446

C Circuit Breakers Trip and Cannot Be Reset
C Figure 104

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
0068


SYSTEM AND/OR SYSTEM SOURCE HSI ANNUNCIATIONS DO NOT ANNUNCIATE PROPERLY
1 Ensure that RAD/INS switch is in INS position and INS transfer switch is positioned to system under test.
• Does INS MTG annunciator illuminate and both HSIs display system under test
NO
YES
2 Normal
3 Which HSI annunciation malfunctions, system and/or source?
SOURCE
BOTH
4 Malfunction probably caused by a faulty RNAV accessory unit.
• Replace RNAV accessory unit (34-42-04)
• If fault persists, RNAV accessory unit relay(s) are probably not actuating. Remove power from relay control circuit and check controlling switch for continuity.
• Replace switch if defective
5 Malfunction probably caused by faulty VHF NAV accessory unit.
• Replace VHF NAV accessory unit (34-55-06).
• If fault persists, check relay control circuit for continuity as in step 4.
• Replace switch if defective.
• If relays operate in steps 3 and 4, but proper HSI annunciation still does not occur, replace HSI (34-55-04) and again test for annunciation

PREREQUISITES

Elec Pwr (24-00-00)

Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

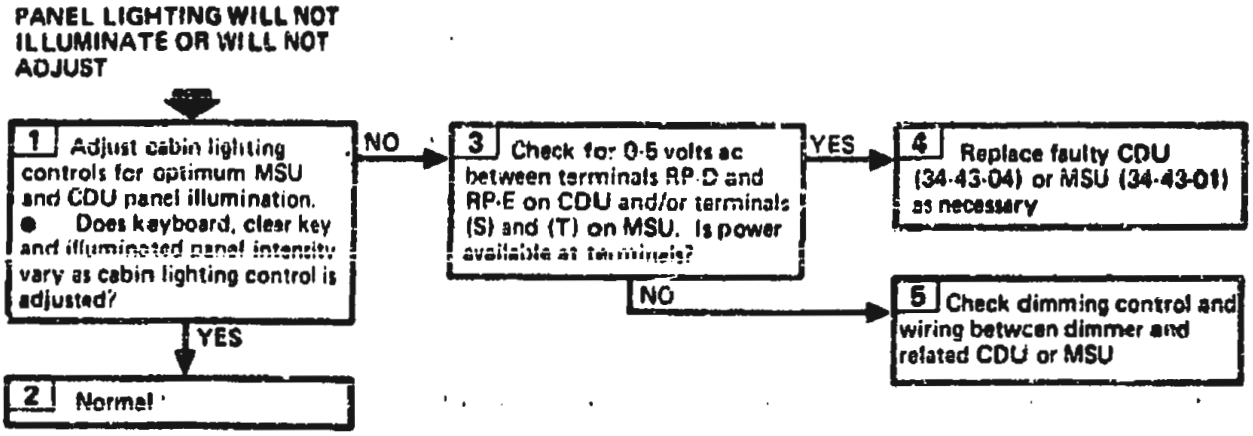
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-447

C System and/or System Source HSI Annunciations Do Not
C Annunciate Properly
C Figure 105

R EFFECTIVITY: INS EQUIPPED AIRCRAFT

R
006B


PANEL LIGHTING WILL NOT ILLUMINATE OR WILL NOT ADJUST
1 Adjust cabin lighting controls for optimum MSU and CDU panel illumination.
● Does keyboard, clear key and illuminated panel intensity vary as cabin lighting control is adjusted?
NO
YES
2 Normal
3 Check for 0-5 volts ac between terminals RP-D and RP-E on CDU and/or terminals (S) and (T) on MSU. Is power available at terminals?
YES
NO
4 Replace faulty CDU (34-43-04) or MSU (34-43-01) as necessary
5 Check dimming control and wiring between dimmer and related CDU or MSU

PREREQUISITES

Elec Pwr (24-00-00)

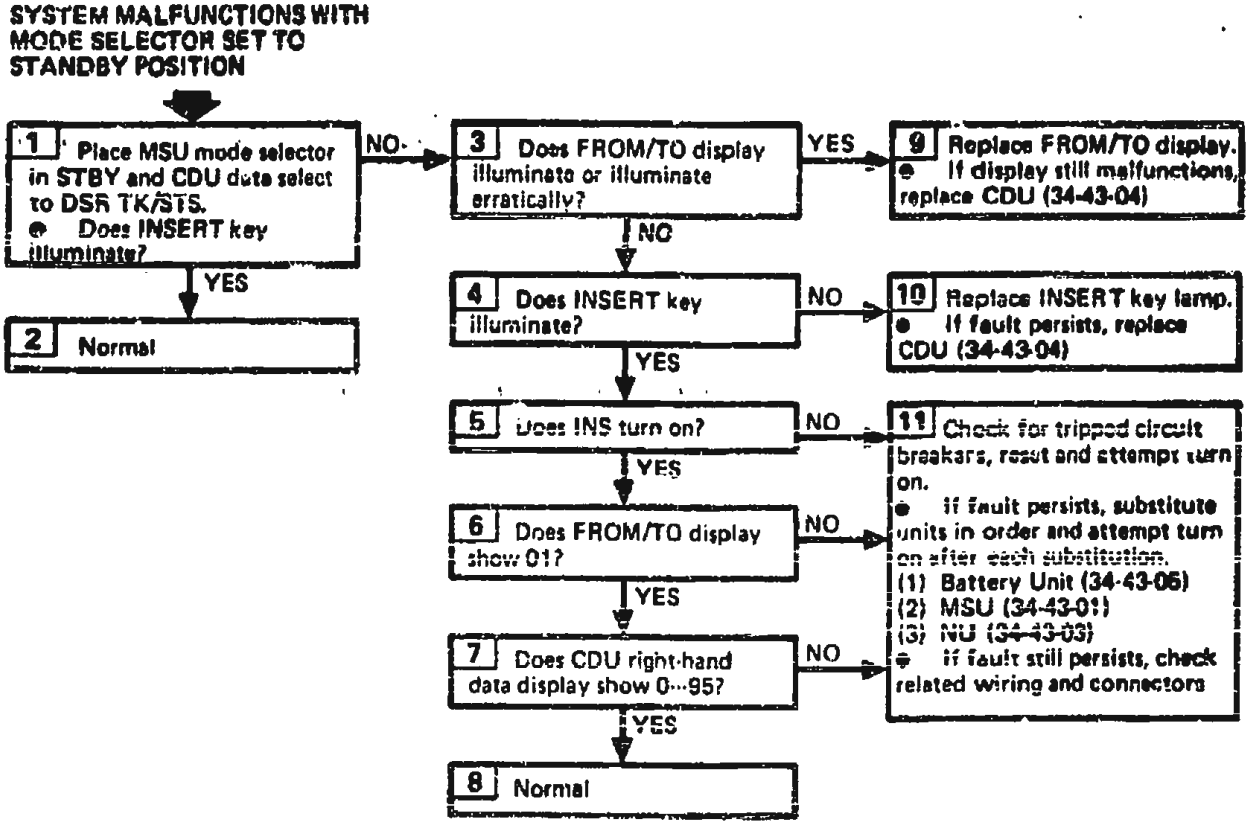
Cooling. Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J18, 1K18, 1K24, 2A21

M1-5000-34-449

C Panel Lighting will Not Illuminate, Or Will Not Adjust
C Figure 106

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B


SYSTEM MALFUNCTIONS WITH MODE SELECTOR SET TO STANDBY POSITION
1 Place MSU mode selector in STBY and CDU data select to DSR TK/STS.
● Does INSERT key illuminate?
NO
YES
2 Normal
3 Does FROM/TO display illuminate or illuminate erratically?
YES
9 Replace FROM/TO display.
● If display still malfunctions, replace CDU (34-43-04)
NO
4 Does INSERT key illuminate?
NO
10 Replace INSERT key lamp.
● If fault persists, replace CDU (34-43-04)
YES
5 Does INS turn on?
NO
11 Check for tripped circuit breakers, reset and attempt turn on.
● If fault persists, substitute units in order and attempt turn on after each substitution.
(1) Battery Unit (34-43-05)
(2) MSU (34-43-01)
(3) NU (34-43-03)
● If fault still persists, check related wiring and connectors
YES
6 Does FROM/TO display show 01?
NO
YES
7 Does CDU right-hand data display show 0···95?
NO
YES
8 Normal

PREREQUISITES

Elec Pwr (24-00-00)

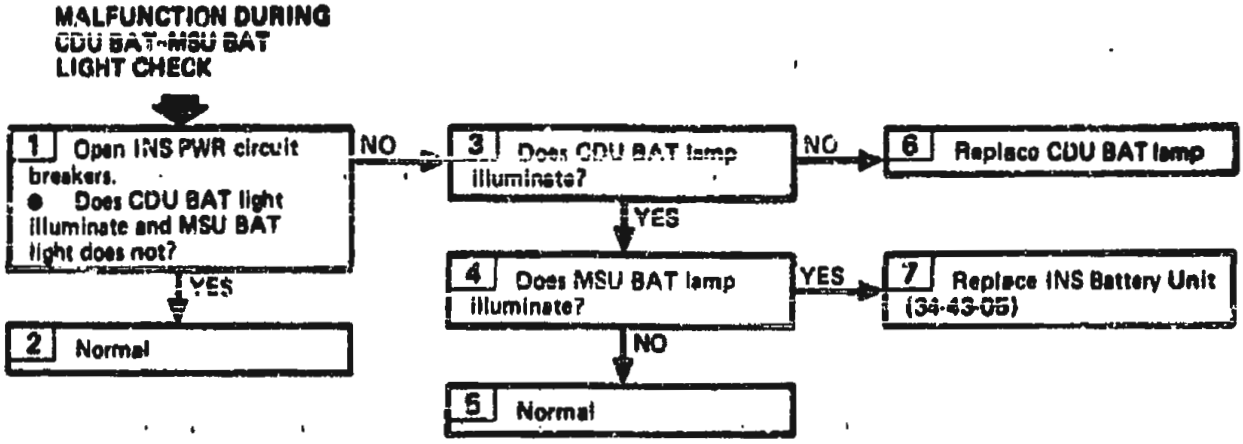
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-460

C System Malfunction With Mode Selector Set to Standby Position
C Figure 107

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B

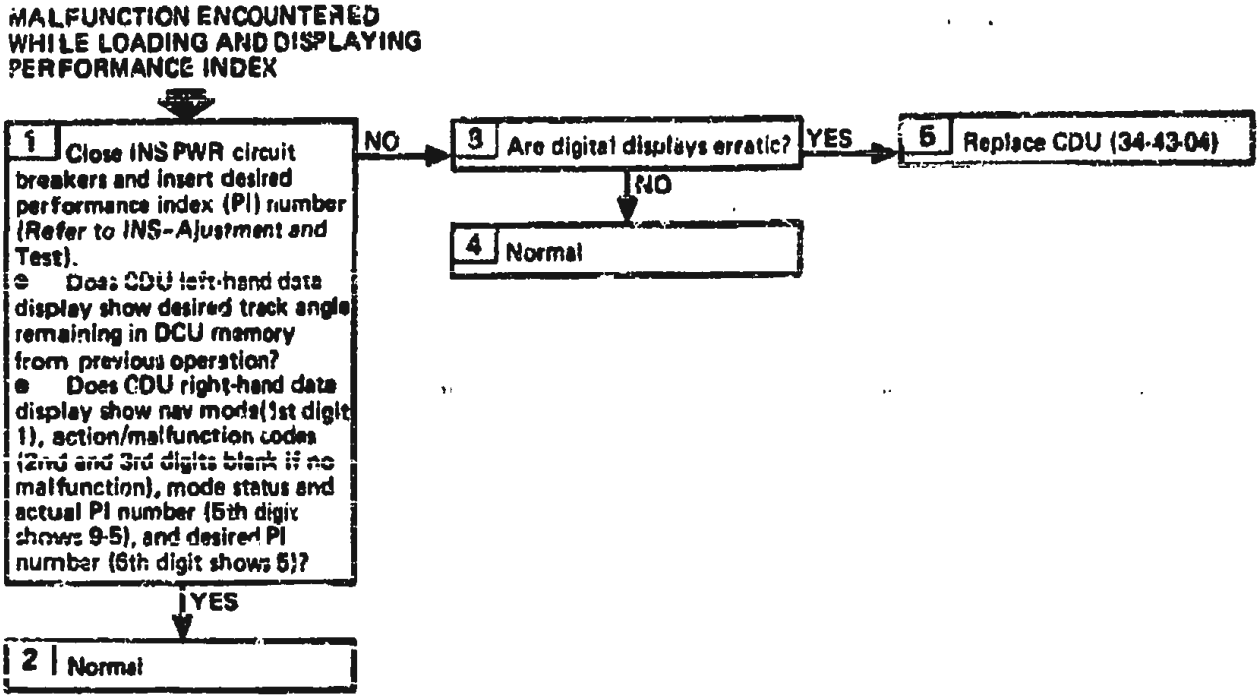


PREREQUISITES
Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-451

C Malfunction During CDU BAT/MSU BAT Light Check
C Figure 108

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B


MALFUNCTION ENCOUNTERED WHILE LOADING AND DISPLAYING PERFORMANCE INDEX
1 Close INS PWR circuit breakers and insert desired performance index (PI) number (Refer to INS-Ajustment and Test).
• Does CDU left-hand data display show desired track angle remaining in DCU memory from previous operation?
• Does CDU right-hand data display show nav mode(1st digit 1), action/malfunction codes (2nd and 3rd digits blank if no malfunction), mode status and actual PI number (5th digit shows 9-5), and desired PI number (6th digit shows 5)?
NO
3 Are digital displays erratic?
YES
5 Replace CDU (34-43-04)
NO
4 Normal
YES
2 Normal

PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-462

C Malfunction Encountered While Loading and Displaying
C Performance Index
C Figure 109

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
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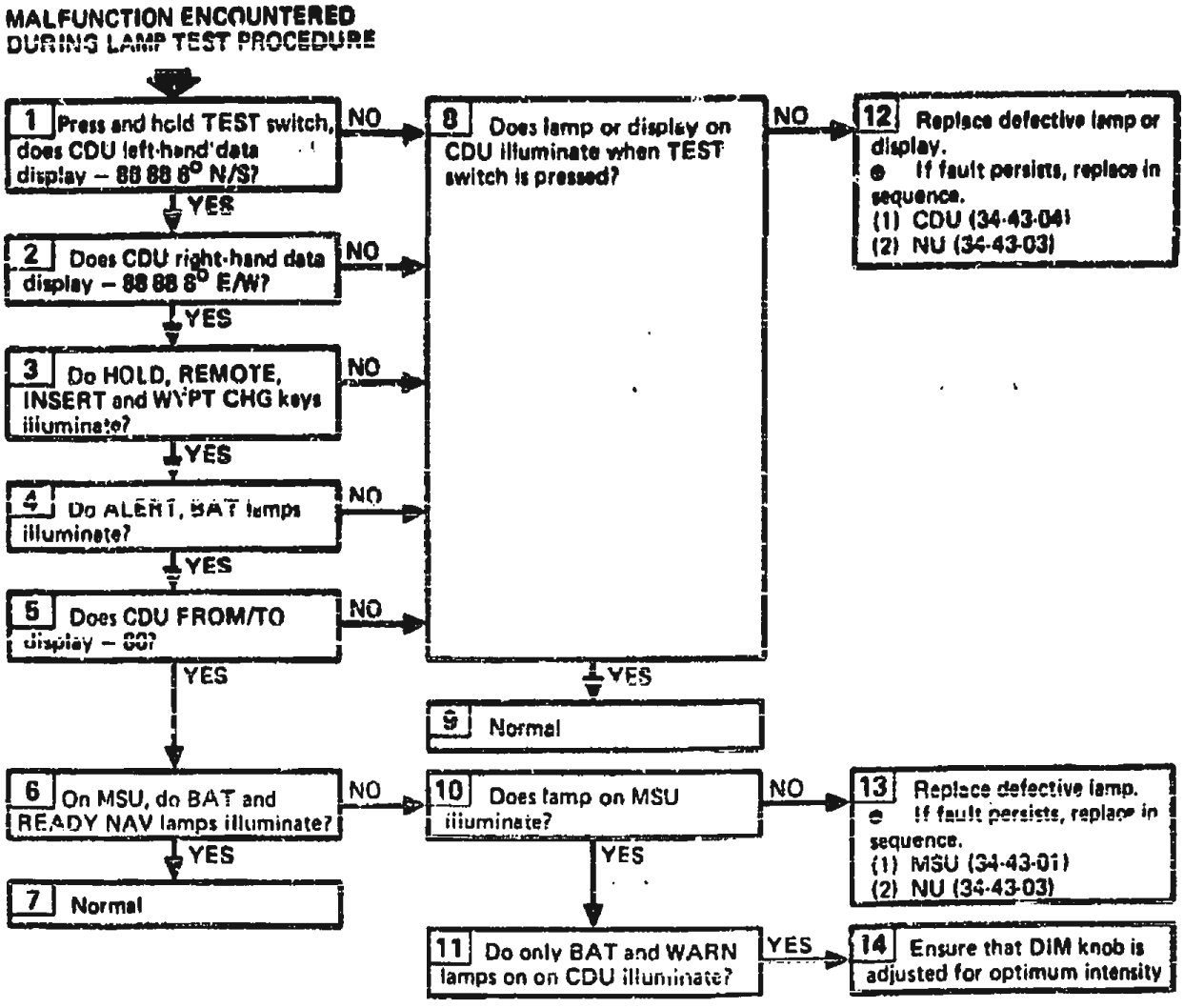
006B


MALFUNCTION ENCOUNTERED DURING LAMP TEST PROCEDURE
1 Press and hold TEST switch, does CDU left-hand data display – 88 88 8° N/S?
NO
YES
2 Does CDU right-hand data display – 88 88 8° E/W?
NO
YES
3 Do HOLD, REMOTE, INSERT and WYPT CHG keys illuminate?
NO
YES
4 Do ALERT, BAT lamps illuminate?
NO
YES
5 Does CDU FROM/TO display – 00?
NO
YES
6 On MSU, do BAT and READY NAV lamps illuminate?
NO
YES
7 Normal
8 Does lamp or display on CDU illuminate when TEST switch is pressed?
NO
YES
9 Normal
12 Replace defective lamp or display.
● If fault persists, replace in sequence.
(1) CDU (34-43-04)
(2) NU (34-43-03)
10 Does lamp on MSU illuminate?
NO
YES
13 Replace defective lamp.
● If fault persists, replace in sequence.
(1) MSU (34-43-01)
(2) NU (34-43-03)
11 Do only BAT and WARN lamps on on CDU illuminate?
YES
14 Ensure that DIM knob is adjusted for optimum intensity

PREREQUISITES

Elec Pwr (24-00-00)

Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

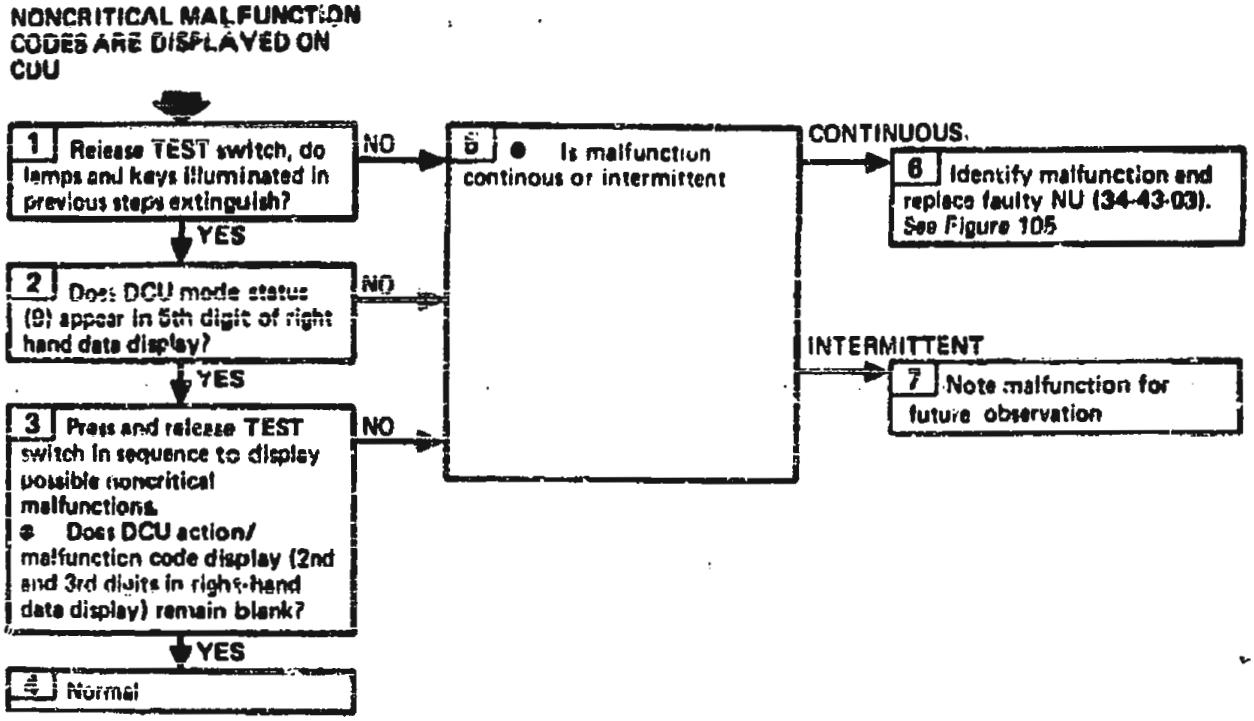
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-454

C C Malfunction Encountered During Lamp Test Procedure
Figure 110

R EFFECTIVITY: INS EQUIPPED AIRCRAFT

R 006B


NONCRITICAL MALFUNCTION CODES ARE DISPLAYED ON CDU
1 Release TEST switch, do lamps and keys illuminated in previous steps extinguish?
NO
YES
2 Does DCU mode status (9) appear in 5th digit of right hand data display?
NO
YES
3 Press and release TEST switch in sequence to display possible noncritical malfunctions.
● Does DCU action/ malfunction code display (2nd and 3rd digits in right-hand data display) remain blank?
NO
YES
4 Normal
5 ● Is malfunction continous or intermittent
CONTINUOUS
6 Identify malfunction and replace faulty NU (34-43-03). See Figure 105
INTERMITTENT
7 Note malfunction for future observation

PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E18, 1E24, 1E25, 1F3, 1F20, 1F21, 1G8, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-6000-34-465

C Noncritical Malfunction Codes Are Displayed on CDU
C Figure 111

R EFFECTIVITY: INS EQUIPPED AIRCRAFT

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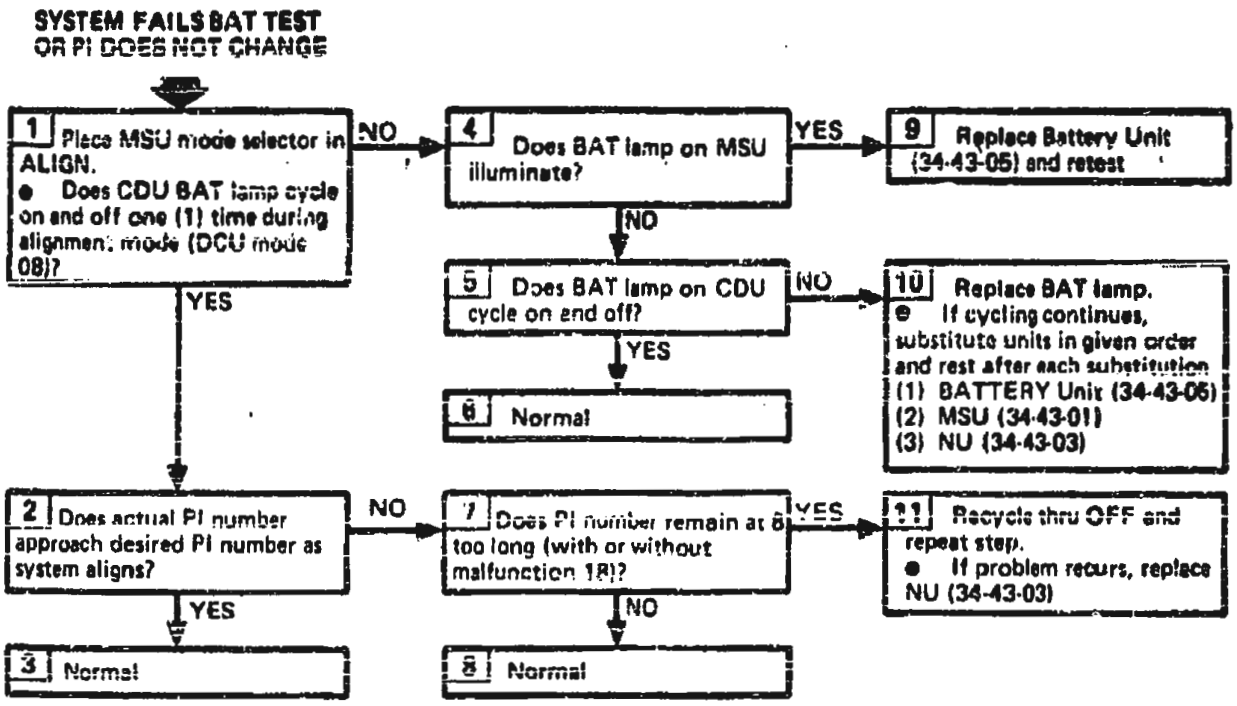
006B


SYSTEM FAILS BAT TEST
OR PI DOES NOT CHANGE
1 Place MSU mode selector in ALIGN.
● Does CDU BAT lamp cycle on and off one (1) time during alignment mode (DCU mode 08)?
NO
4 Does BAT lamp on MSU illuminate?
YES
9 Replace Battery Unit (34-43-05) and retest
NO
5 Does BAT lamp on CDU cycle on and off?
NO
10 Replace BAT lamp.
● If cycling continues, substitute units in given order and test after each substitution
(1) BATTERY Unit (34-43-05)
(2) MSU (34-43-01)
(3) NU (34-43-03)
YES
6 Normal
YES
2 Does actual PI number approach desired PI number as system aligns?
NO
7 Does PI number remain at 0 too long (with or without malfunction 18)?
YES
11 Recycle thru OFF and repeat step.
● If problem recurs, replace NU (34-43-03)
YES
NO
3 Normal
8 Normal

PREREQUISITES

Elec Pwr (24-00-00)

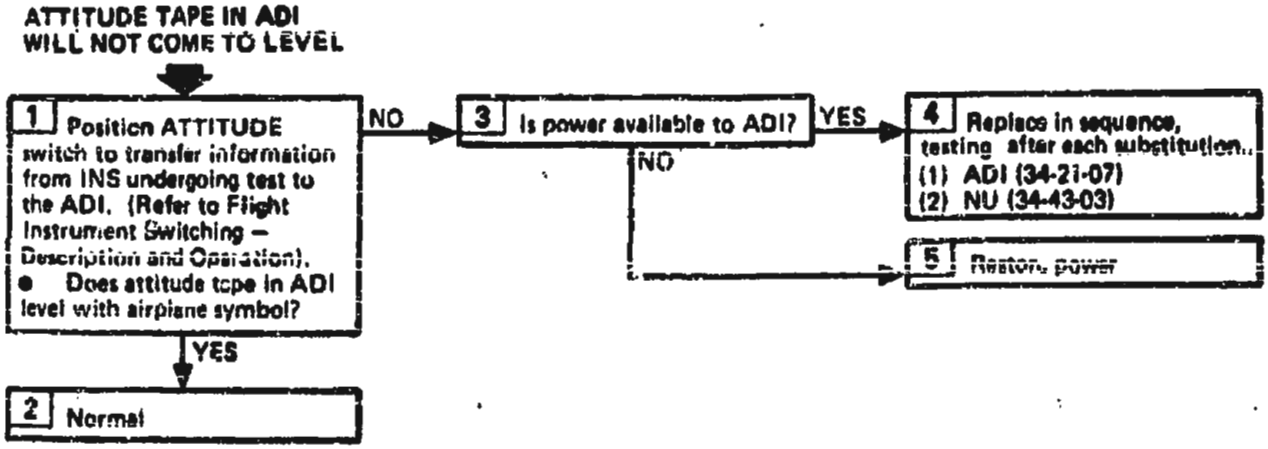
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-[illegible]-34-[illegible]

C System Fails BAT Test or PI Does Not Change
C Figure 112

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B


ATTITUDE TAPE IN ADI WILL NOT COME TO LEVEL
1 Position ATTITUDE switch to transfer information from INS undergoing test to the ADI. (Refer to Flight Instrument Switching – Description and Operation).
• Does attitude tape in ADI level with airplane symbol?
NO
YES
2 Normal
3 Is power available to ADI?
YES
NO
4 Replace in sequence, testing after each substitution.
(1) ADI (34-21-07)
(2) NU (34-43-03)
5 Restore power

PREREQUISITES

Elec Pwr (24-00-00)

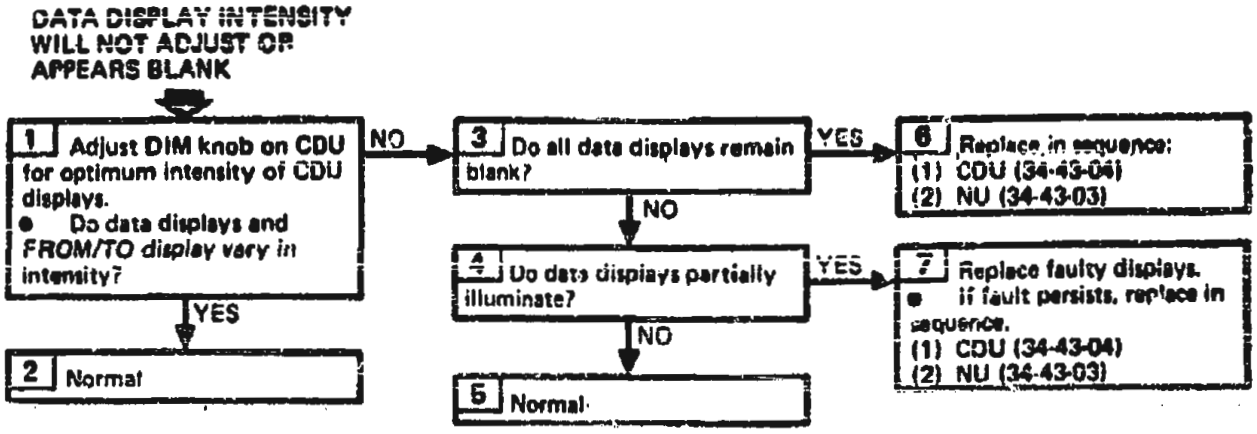
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out

CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-6000-24-457

C C Attitude Tape In ADI Will Not Come to Level
Figure 113

R R 006B EFFECTIVITY: INS EQUIPPED AIRCRAFT


DATA DISPLAY INTENSITY WILL NOT ADJUST OR APPEARS BLANK
1 Adjust DIM knob on CDU for optimum intensity of CDU displays.
• Do data displays and FROM/TO display vary in intensity?
NO
YES
2 Normal
3 Do all data displays remain blank?
YES
NO
6 Replace in sequence:
(1) CDU (34-43-04)
(2) NU (34-43-03)
4 Do data displays partially illuminate?
YES
NO
7 Replace faulty displays.
• If fault persists, replace in sequence.
(1) CDU (34-43-04)
(2) NU (34-43-03)
5 Normal

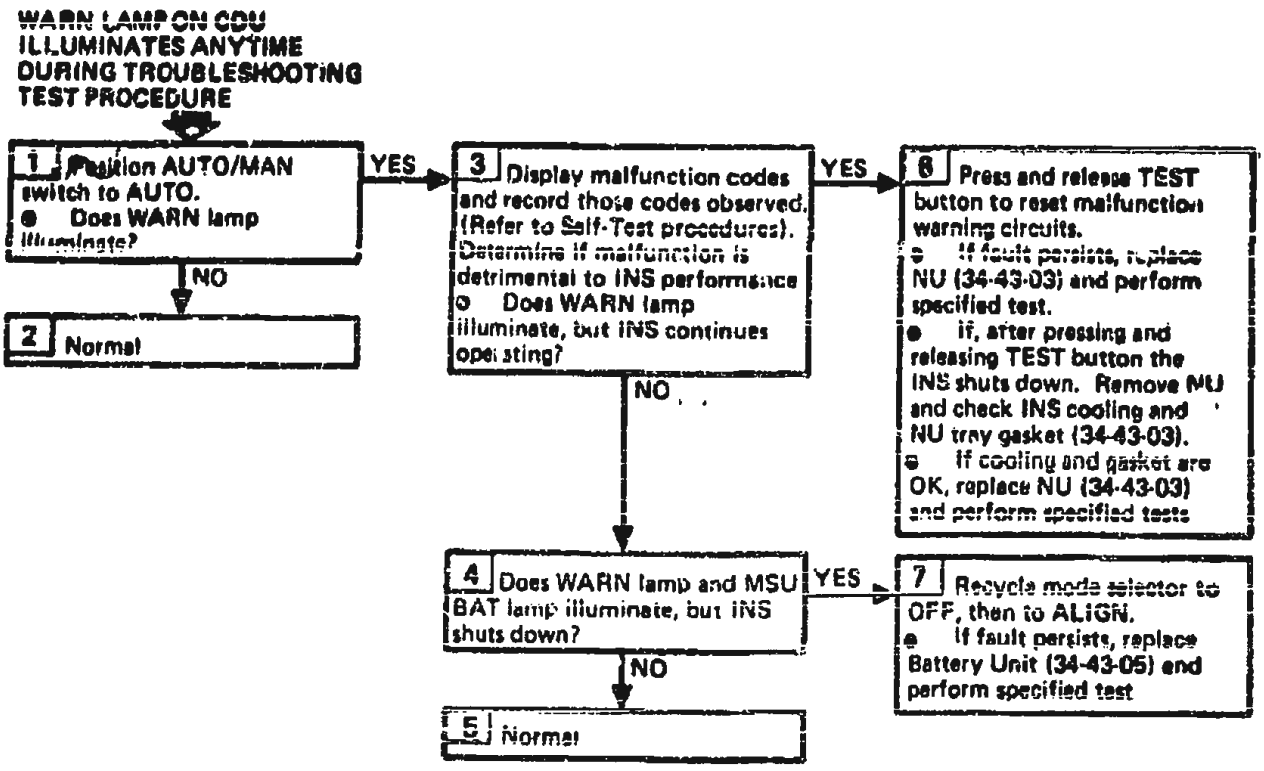
PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G26, 1J19, 1K19, 1K24, 2A21

M1-6000-34-458

C Data Display Intensity Will Not Adjust or Appear Blank
C Figure 114

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B


WARN LAMP ON CDU ILLUMINATES ANYTIME DURING TROUBLESHOOTING TEST PROCEDURE
1 Position AUTO/MAN switch to AUTO.
● Does WARN lamp illuminate?
YES
NO
2 Normal
3 Display malfunction codes and record those codes observed. (Refer to Self-Test procedures). Determine if malfunction is detrimental to INS performance
● Does WARN lamp illuminate, but INS continues operating?
YES
NO
6 Press and release TEST button to reset malfunction warning circuits.
● If fault persists, replace NU (34-43-03) and perform specified test.
● If, after pressing and releasing TEST button the INS shuts down. Remove NU and check INS cooling and NU tray gasket (34-43-03).
● If cooling and gasket are OK, replace NU (34-43-03) and perform specified tests
4 Does WARN lamp and MSU BAT lamp illuminate, but INS shuts down?
YES
NO
7 Recycle mode selector to OFF, then to ALIGN.
● If fault persists, replace Battery Unit (34-43-05) and perform specified test
5 Normal

NOTE
Observe WARN lamp on CDU throughout remaining portion of checkout procedure

PREREQUISITES
Elec Pwr (24-00-00)
Cooling: Verify AVIONIC AIR-FWD, MID and INS COOLING LO FLO lights on FE/SO ECS MONITOR panel are out
CBs: 1D8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21

M1-5000-34-459

C Warn Lamp On CDU Illuminates Anytime During
C Troubleshooting Test Procedure
C Figure 115

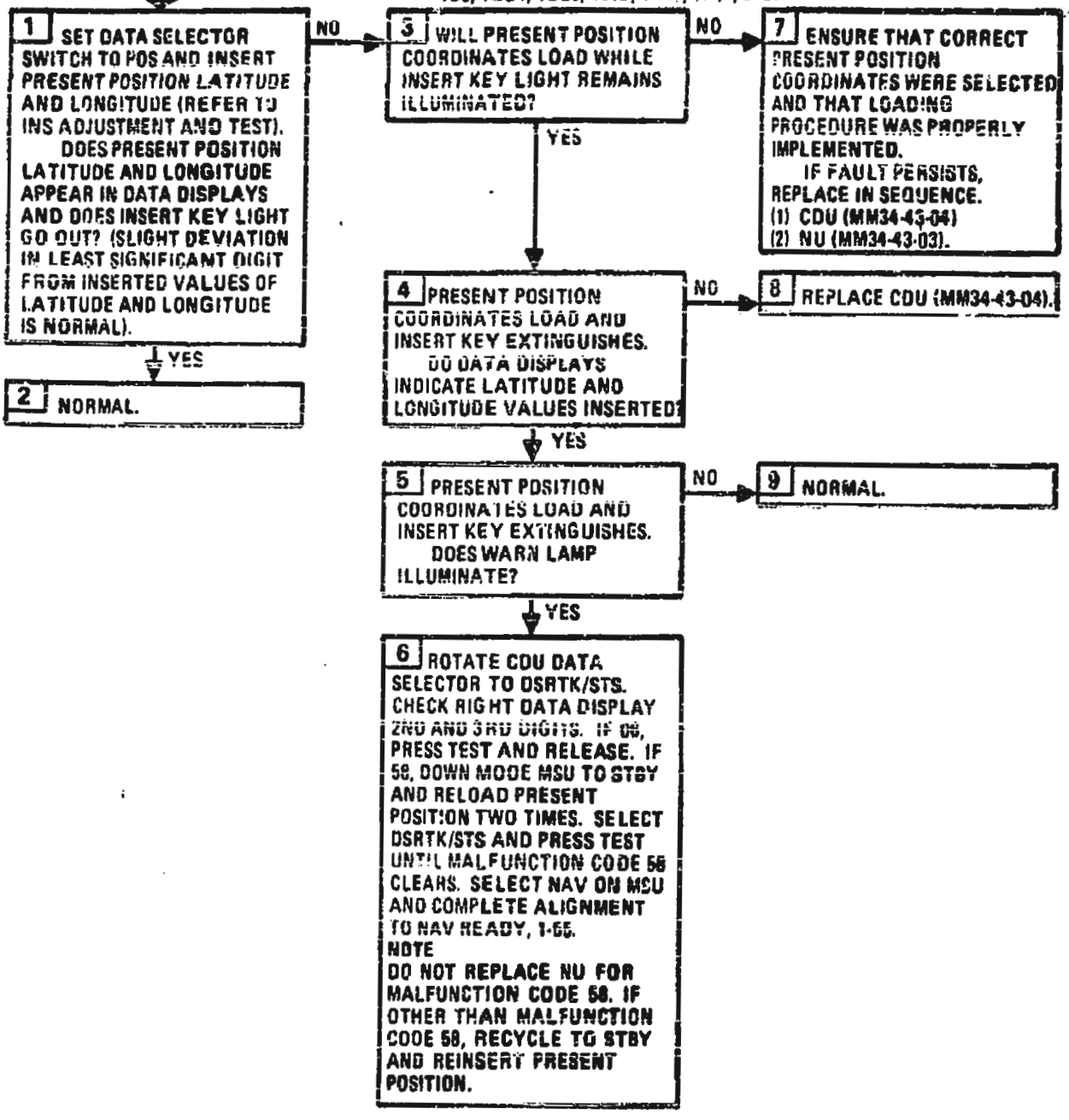
R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)

COOLING: VERIFY AVIONIC AIR - FWD, MID AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT.

CB'S: 1D8, 1D26, 1E1, 1E2, 1E8, 1E7, 1E18, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21


MALFUNCTION ENCOUNTERED WHILE LOADING PRESENT POSITION COORDINATES
1 SET DATA SELECTOR SWITCH TO POS AND INSERT PRESENT POSITION LATITUDE AND LONGITUDE (REFER TO INS ADJUSTMENT AND TEST). DOES PRESENT POSITION LATITUDE AND LONGITUDE APPEAR IN DATA DISPLAYS AND DOES INSERT KEY LIGHT GO OUT? (SLIGHT DEVIATION IN LEAST SIGNIFICANT DIGIT FROM INSERTED VALUES OF LATITUDE AND LONGITUDE IS NORMAL).
NO
YES
2 NORMAL.
3 WILL PRESENT POSITION COORDINATES LOAD WHILE INSERT KEY LIGHT REMAINS ILLUMINATED?
NO
YES
7 ENSURE THAT CORRECT PRESENT POSITION COORDINATES WERE SELECTED AND THAT LOADING PROCEDURE WAS PROPERLY IMPLEMENTED. IF FAULT PERSISTS, REPLACE IN SEQUENCE. (1) CDU (MM34-43-04) (2) NU (MM34-43-03).
4 PRESENT POSITION COORDINATES LOAD AND INSERT KEY EXTINGUISHES. DO DATA DISPLAYS INDICATE LATITUDE AND LONGITUDE VALUES INSERTED?
NO
8 REPLACE CDU (MM34-43-04).
YES
5 PRESENT POSITION COORDINATES LOAD AND INSERT KEY EXTINGUISHES. DOES WARN LAMP ILLUMINATE?
NO
9 NORMAL.
YES
6 ROTATE CDU DATA SELECTOR TO DSRTK/STS. CHECK RIGHT DATA DISPLAY 2ND AND 3RD DIGITS. IF 00, PRESS TEST AND RELEASE. IF 58, DOWN MODE MSU TO STBY AND RELOAD PRESENT POSITION TWO TIMES. SELECT DSRTK/STS AND PRESS TEST UNTIL MALFUNCTION CODE 58 CLEARS. SELECT NAV ON MSU AND COMPLETE ALIGNMENT TO NAV READY, 1-65.
NOTE
DO NOT REPLACE NU FOR MALFUNCTION CODE 58. IF OTHER THAN MALFUNCTION CODE 58, RECYCLE TO STBY AND REINSERT PRESENT POSITION.

M1-0000-34-3486

C C Malfunction Encountered While Loading Present Position Coordinates
Figure 116

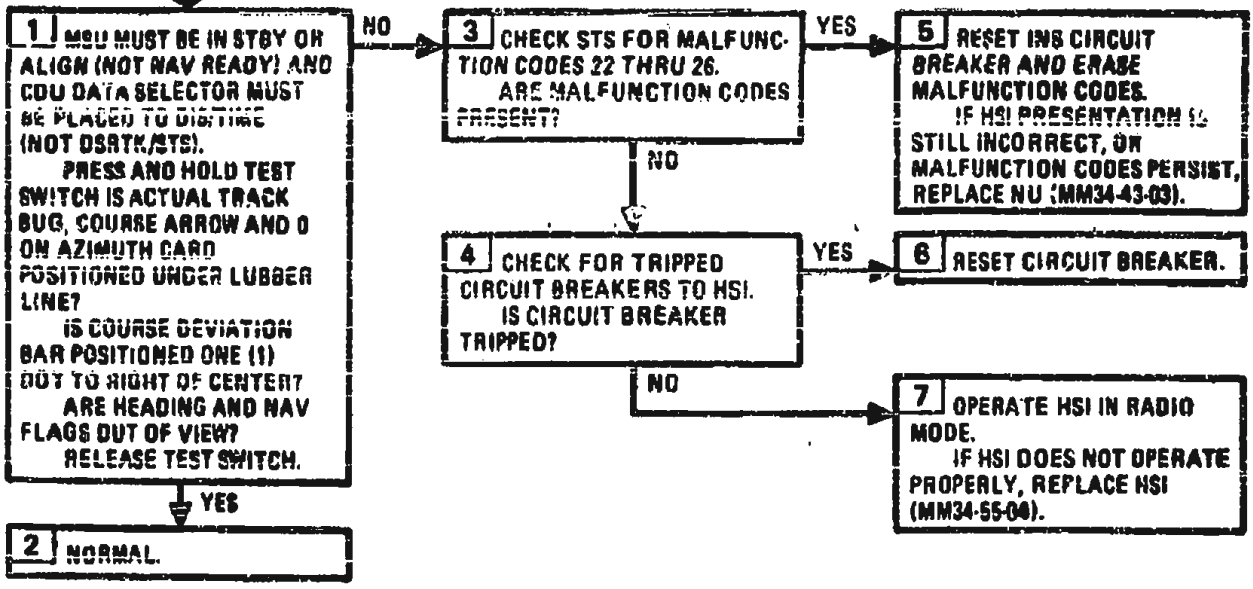
R R 006B EFFECTIVITY: INS EQUIPPED AIRCRAFT

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)

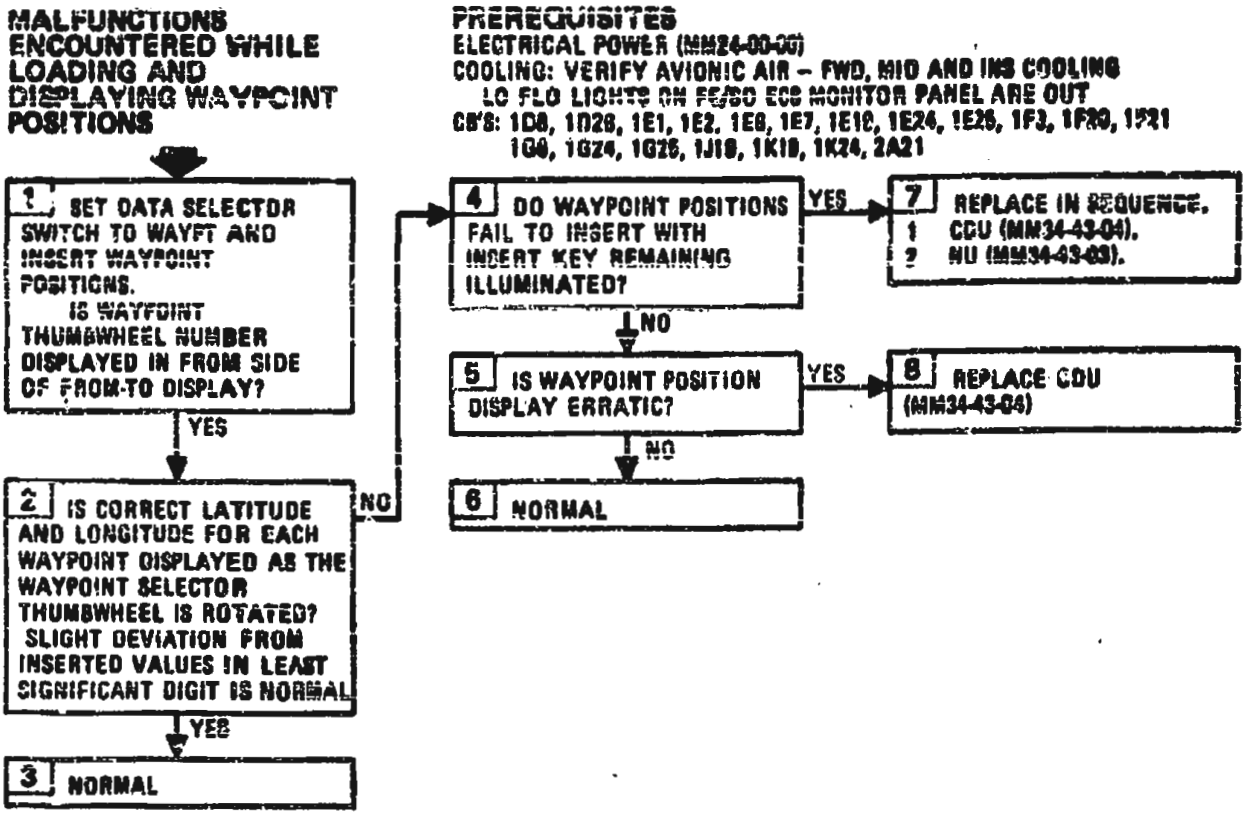
COOLING: VERIFY AVIONIC AIR – FWD, MID AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT

CB'S: 1D8, 1D28, 1E1, 1E6, 1E7, 1E19, 1E24, 1E26, 1F8, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21


HSI PRESENTATION INCORRECT WITH TEST SWITCH HELD DOWN
1 MSU MUST BE IN STBY OR ALIGN (NOT NAV READY) AND CDU DATA SELECTOR MUST BE PLACED TO DIS/TIME (NOT DSRTK/STS).
PRESS AND HOLD TEST SWITCH IS ACTUAL TRACK BUG, COURSE ARROW AND 0 ON AZIMUTH CARD POSITIONED UNDER LUBBER LINE?
IS COURSE DEVIATION BAR POSITIONED ONE (1) DOT TO RIGHT OF CENTER?
ARE HEADING AND NAV FLAGS OUT OF VIEW?
RELEASE TEST SWITCH.
NO
YES
2 NORMAL.
3 CHECK STS FOR MALFUNCTION CODES 22 THRU 26.
ARE MALFUNCTION CODES PRESENT?
YES
NO
5 RESET INS CIRCUIT BREAKER AND ERASE MALFUNCTION CODES.
IF HSI PRESENTATION IS STILL INCORRECT, OR MALFUNCTION CODES PERSIST, REPLACE NU (MM34-43-03).
4 CHECK FOR TRIPPED CIRCUIT BREAKERS TO HSI.
IS CIRCUIT BREAKER TRIPPED?
YES
6 RESET CIRCUIT BREAKER.
NO
7 OPERATE HSI IN RADIO MODE.
IF HSI DOES NOT OPERATE PROPERLY, REPLACE HSI (MM34-55-06).

M1-0001-34-461

C HSI Presentation Incorrect With Test Switch Held Down
C Figure 117


MALFUNCTIONS ENCOUNTERED WHILE LOADING AND DISPLAYING WAYPOINT POSITIONS
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR – FWD, MID AND INS COOLING
LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D8, 1D28, 1E1, 1E2, 1E8, 1E7, 1E10, 1E24, 1E25, 1F3, 1F20, 1F21
1G6, 1G24, 1G25, 1J18, 1K18, 1K24, 2A21
1 SET DATA SELECTOR SWITCH TO WAYPT AND INSERT WAYPOINT POSITIONS.
IS WAYPOINT THUMBWHEEL NUMBER DISPLAYED IN FROM SIDE OF FROM-TO DISPLAY?
YES
NO
2 IS CORRECT LATITUDE AND LONGITUDE FOR EACH WAYPOINT DISPLAYED AS THE WAYPOINT SELECTOR THUMBWHEEL IS ROTATED? SLIGHT DEVIATION FROM INSERTED VALUES IN LEAST SIGNIFICANT DIGIT IS NORMAL
YES
3 NORMAL
4 DO WAYPOINT POSITIONS FAIL TO INSERT WITH INSERT KEY REMAINING ILLUMINATED?
YES
7 REPLACE IN SEQUENCE.
1 CDU (MM34-43-04).
2 NU (MM34-43-09).
NO
5 IS WAYPOINT POSITION DISPLAY ERRATIC?
YES
8 REPLACE CDU (MM34-43-04)
NO
6 NORMAL

M1-0001-34-462

C Malfunction Encountered While Loading and Displaying
C Waypoint Positions
C Figure 118

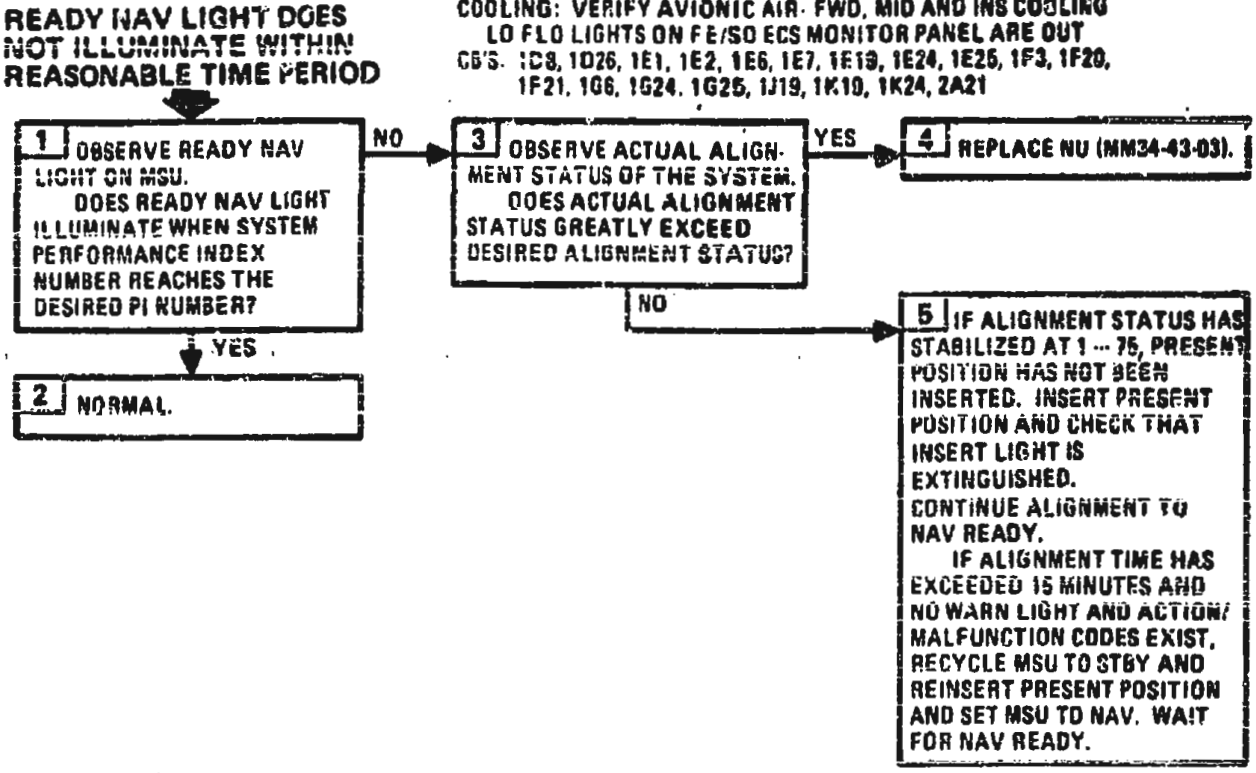
R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
0068

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)

COOLING: VERIFY AVIONIC AIR- FWD, MID AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT

CB'S: 1C8, 1D26, 1E1, 1E2, 1E6, 1E7, 1E19, 1E24, 1E25, 1F3, 1F20, 1F21, 1G6, 1G24, 1G25, 1J19, 1K19, 1K24, 2A21


READY NAV LIGHT DOES NOT ILLUMINATE WITHIN REASONABLE TIME PERIOD
1 OBSERVE READY NAV LIGHT ON MSU.
DOES READY NAV LIGHT ILLUMINATE WHEN SYSTEM PERFORMANCE INDEX NUMBER REACHES THE DESIRED PI NUMBER?
NO
YES
2 NORMAL.
3 OBSERVE ACTUAL ALIGNMENT STATUS OF THE SYSTEM.
DOES ACTUAL ALIGNMENT STATUS GREATLY EXCEED DESIRED ALIGNMENT STATUS?
YES
4 REPLACE NU (MM34-43-03).
NO
5 IF ALIGNMENT STATUS HAS STABILIZED AT 1 — 75, PRESENT POSITION HAS NOT BEEN INSERTED. INSERT PRESENT POSITION AND CHECK THAT INSERT LIGHT IS EXTINGUISHED.
CONTINUE ALIGNMENT TO NAV READY.
IF ALIGNMENT TIME HAS EXCEEDED 15 MINUTES AND NO WARN LIGHT AND ACTION/MALFUNCTION CODES EXIST, RECYCLE MSU TO STBY AND REINSERT PRESENT POSITION AND SET MSU TO NAV. WAIT FOR NAV READY.

M1-0000-34-3405

C READY NAV Light Does Not Illuminate Within Reasonable Time Period
C Figure 119

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
0068

WHEN MALFUNCTION ENCOUNTERED WHEN SYSTEM OPERATING IN NAV MODE, NAVIGATION DATA ERRATIC

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONIC AIR – FWD, MID AND INS COOLING LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CBs: 1D9, 1D28, 1E1, 1E2, 1E6, 1E7, 1E18, 1E24, 1E25, 1F3, 1F20, 1F21, 1G5, 1G24, 1G25, 1J18, 1K18, 1K24, 2A21

1 SET MODE SELECTOR TO NAV AND OBSERVE NAVIGATION DATA ON CDU AND FLIGHT INSTRUMENTS. ARE CDU AND FLIGHT INSTRUMENT DISPLAYS AS FOLLOWS?

1 READY NAV LAMP REMAINS LIGHTED
2 NAV AND HEADING FLAGS IN HSI RETRACT
3 CDU DISPLAYS AS FOLLOWS: (REFER TO CONTROL DISPLAY UNIT – DESCRIPTION AND OPERATION)

	DSS POSITION	L-H DISPLAY	R-H DISPLAY	FROM/TO DISPLAY
(a)	TK/GS	TRUE HDG	000	
(b)	HDG/DA	TRUE HDG	000	
(c)	XTK/TKE	ACTUAL CROSS-TRACK	DESIRED TRACK MINUS HEADING	
(d)	POS	PRESENT POSITION LATITUDE	PRESENT POSITION LONGITUDE	
(e)	WAYPT (ROTATE THUMB-WHEEL)	WAY POINT LATITUDE	WAYPOINT LONGITUDE	WAYPOINT NUMBER OR THUMB-WHEEL SWITCH AGREES WITH NUMBER IN FROM DISPLAY
(f)	DIS/TIME	DISTANCE FROM POS TO WAYPOINT NUMBER 1	999.9	
(g)	WIND	000	000	
(h)	DSRTK/STS	DESIRED TRACK ANGLE	ALIGNMENT STA	

3 HSI DISPLAY (REFER TO HORIZONTAL SITUATION INDICATOR – DESCRIPTION AND OPERATION)
(a) TRUE HEADING
(b) DESIRED TRACK ANGLE
(c) DESIRED TRACK ANGLE MINUS TRUE HEADING
(d) CROSS TRACK DISTANCE

4 ADI DISPLAYS AIRPLANE ATTITUDE (NORMALLY LEVEL)

YES

2 SYSTEM HAS PASSED TROUBLESHOOTING TEST PROCEDURE. DYNAMIC TESTING OF THE SYSTEM IN FLIGHT CAN BE ACCOMPLISHED BY FOLLOWING STANDARD INFLIGHT OPERATING PROCEDURES.

NO

3 IS NAVIGATION DATA ERRATIC ON CDU AND NOT ERRATIC ON FLIGHT INSTRUMENTS?

YES → **7** REPLACE IN SEQUENCE:
1 CDU (MM34-43-04)
2 NU (MM34-43-03).

NO

4 IS NAVIGATION DATA ON FLIGHT INSTRUMENT AND NOT ON CDU?

YES → **8** REPLACE DEFECTIVE INSTRUMENTS.

NO

5 IS DISPLAYED DATA OUT OF TOLERANCE, OR WARNING FLAG VOLTAGE DROPS TO ZERO (0), OR NAVIGATION DATA ERRATIC ON CDU AND ON FLIGHT INSTRUMENTS?

NO → **6** NORMAL.

YES → **9** REPLACE NU (MM34-43-03).

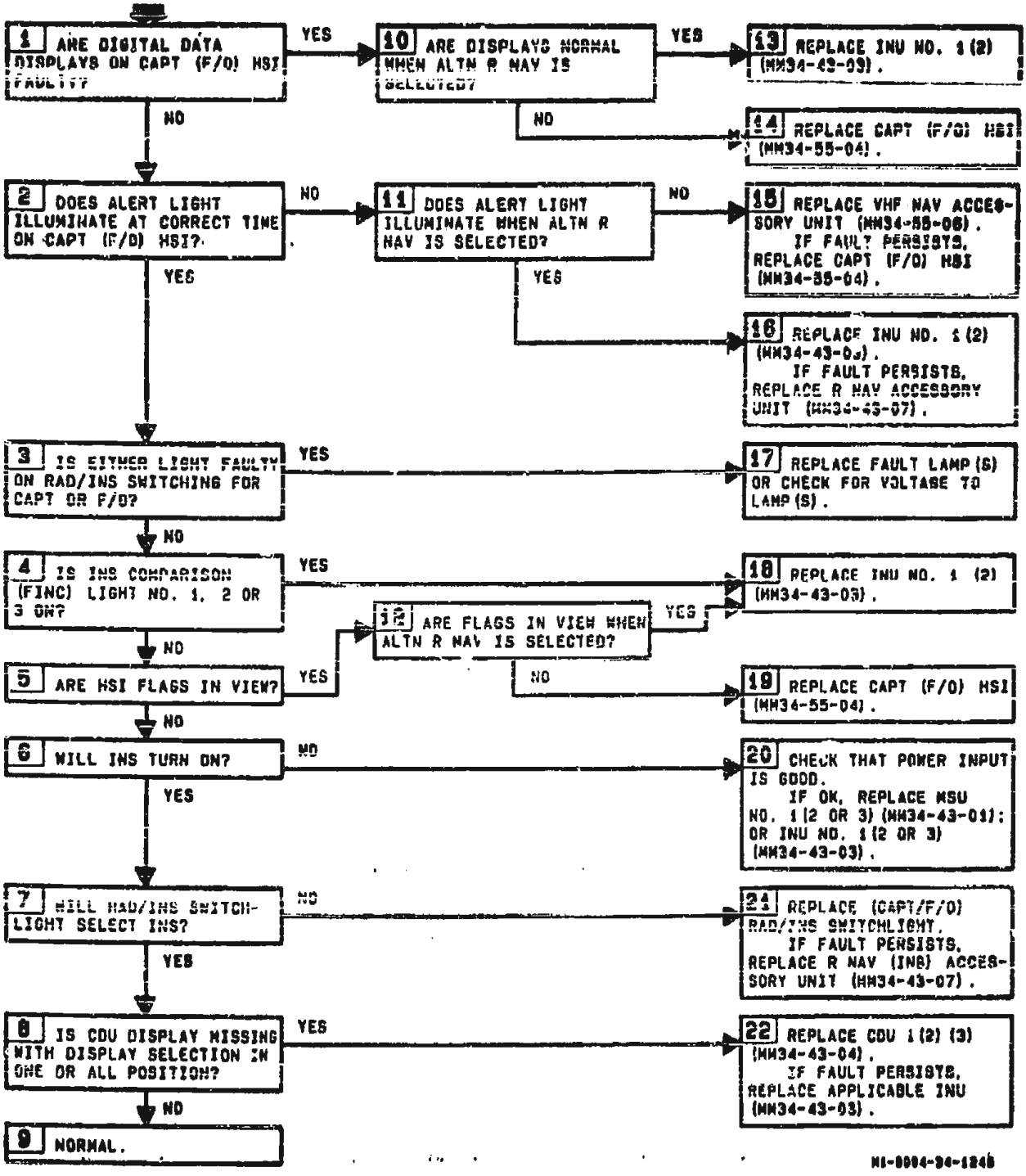
M1-0001-34-485

C C C Malfunction Encountered When System Operating In NAV Mode, Navigation Data Erratic
Figure 120

R R 006B EFFECTIVITY: INS EQUIPPED AIRCRAFT

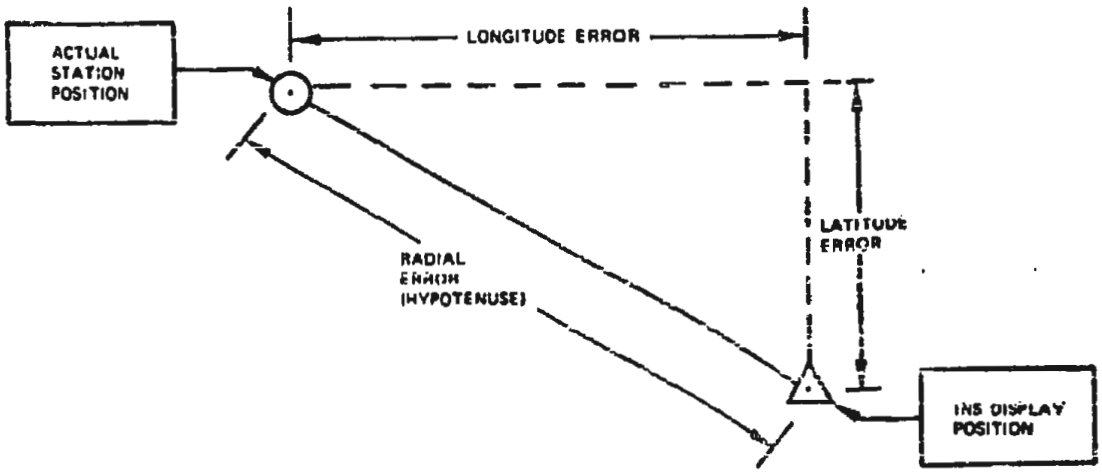
PREREQUISITES
NONE

INS SYSTEM FAULTS


1 ARE DIGITAL DATA DISPLAYS ON CAPT (F/O) HSI FAULTY?
YES
10 ARE DISPLAYS NORMAL WHEN ALTN R NAV IS SELECTED?
YES
13 REPLACE INU NO. 1 (2) (MM34-43-09).
NO
14 REPLACE CAPT (F/O) HSI (MM34-55-04).
NO
2 DOES ALERT LIGHT ILLUMINATE AT CORRECT TIME ON CAPT (F/O) HSI?
NO
11 DOES ALERT LIGHT ILLUMINATE WHEN ALTN R NAV IS SELECTED?
NO
15 REPLACE VHF NAV ACCESSORY UNIT (MM34-55-06). IF FAULT PERSISTS, REPLACE CAPT (F/O) HSI (MM34-55-04).
YES
YES
16 REPLACE INU NO. 1 (2) (MM34-43-09). IF FAULT PERSISTS, REPLACE R NAV ACCESSORY UNIT (MM34-43-07).
3 IS EITHER LIGHT FAULTY ON RAD/INS SWITCHING FOR CAPT OR F/O?
YES
17 REPLACE FAULT LAMP (S) OR CHECK FOR VOLTAGE TO LAMP (S).
NO
4 IS INS COMPARISON (FINC) LIGHT NO. 1, 2 OR 3 ON?
YES
18 REPLACE INU NO. 1 (2) (MM34-43-03).
NO
12 ARE FLAGS IN VIEW WHEN ALTN R NAV IS SELECTED?
YES
5 ARE HSI FLAGS IN VIEW?
YES
NO
19 REPLACE CAPT (F/O) HSI (MM34-55-04).
NO
6 WILL INS TURN ON?
NO
20 CHECK THAT POWER INPUT IS GOOD. IF OK, REPLACE MSU NO. 1 (2 OR 3) (MM34-43-01); OR INU NO. 1 (2 OR 3) (MM34-43-03).
YES
7 WILL RAD/INS SWITCH-LIGHT SELECT INS?
NO
21 REPLACE (CAPT/F/O) RAD/INS SWITCHLIGHT. IF FAULT PERSISTS, REPLACE R NAV (INS) ACCESSORY UNIT (MM34-43-07).
YES
8 IS CDU DISPLAY MISSING WITH DISPLAY SELECTION IN ONE OR ALL POSITION?
YES
22 REPLACE CDU 1 (2) (3) (MM34-43-04). IF FAULT PERSISTS, REPLACE APPLICABLE INU (MM34-43-03).
NO
9 NORMAL.

C
C INS System Faults (General)
Figure 121

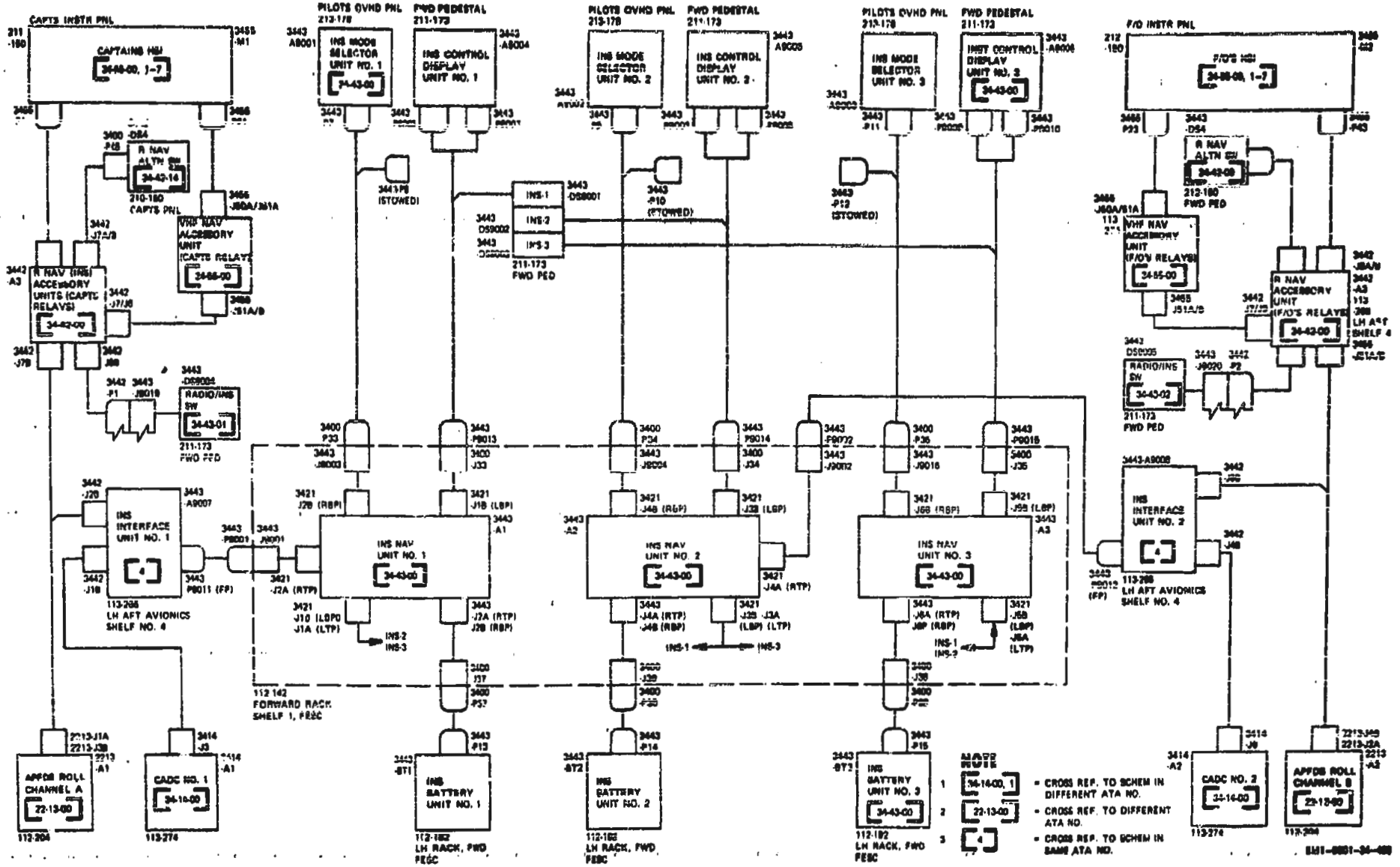
R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B



M1-6000-34-0220

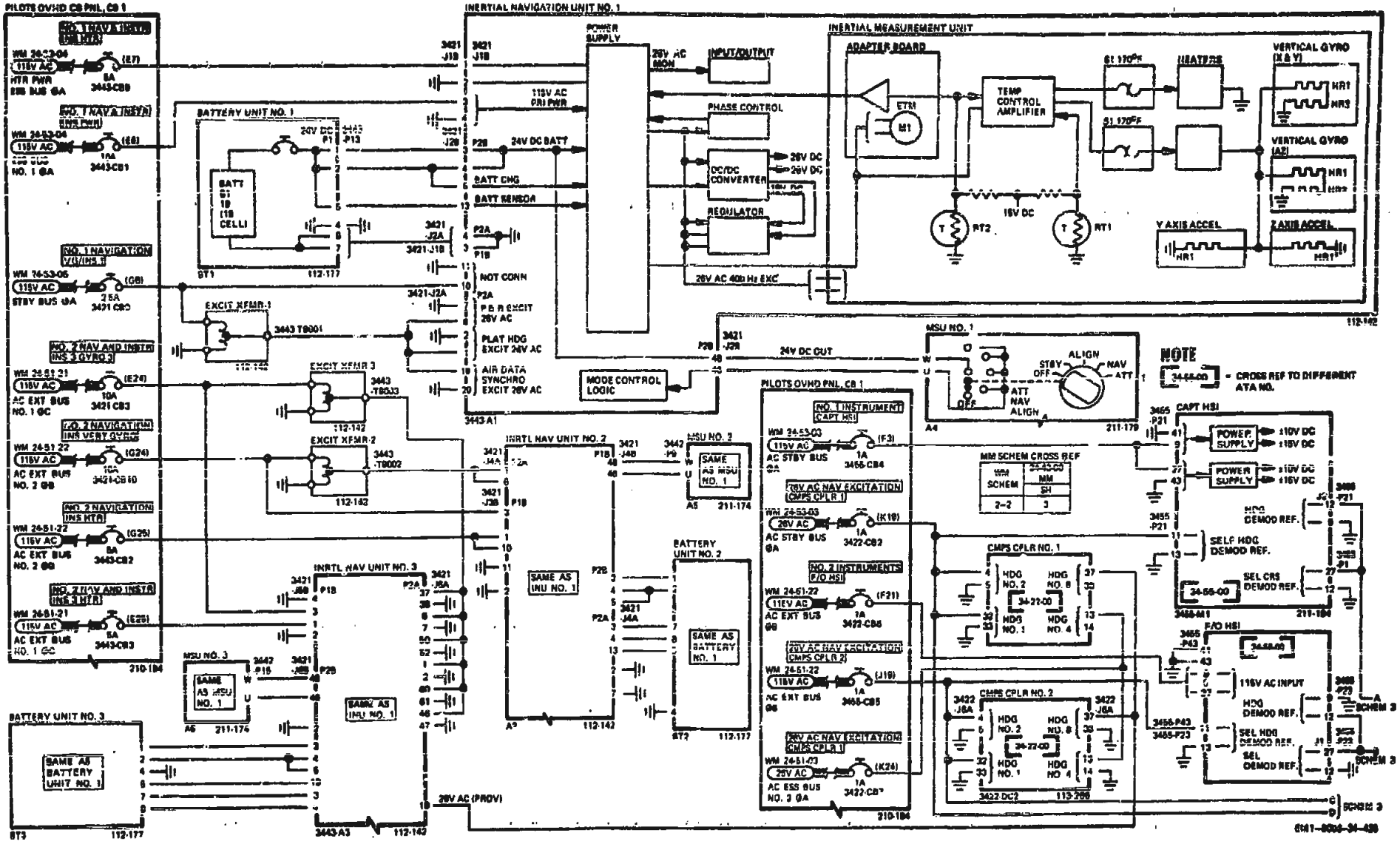
C Radial Error Per Hour Calibration Procedure
C Figure 122

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
006B



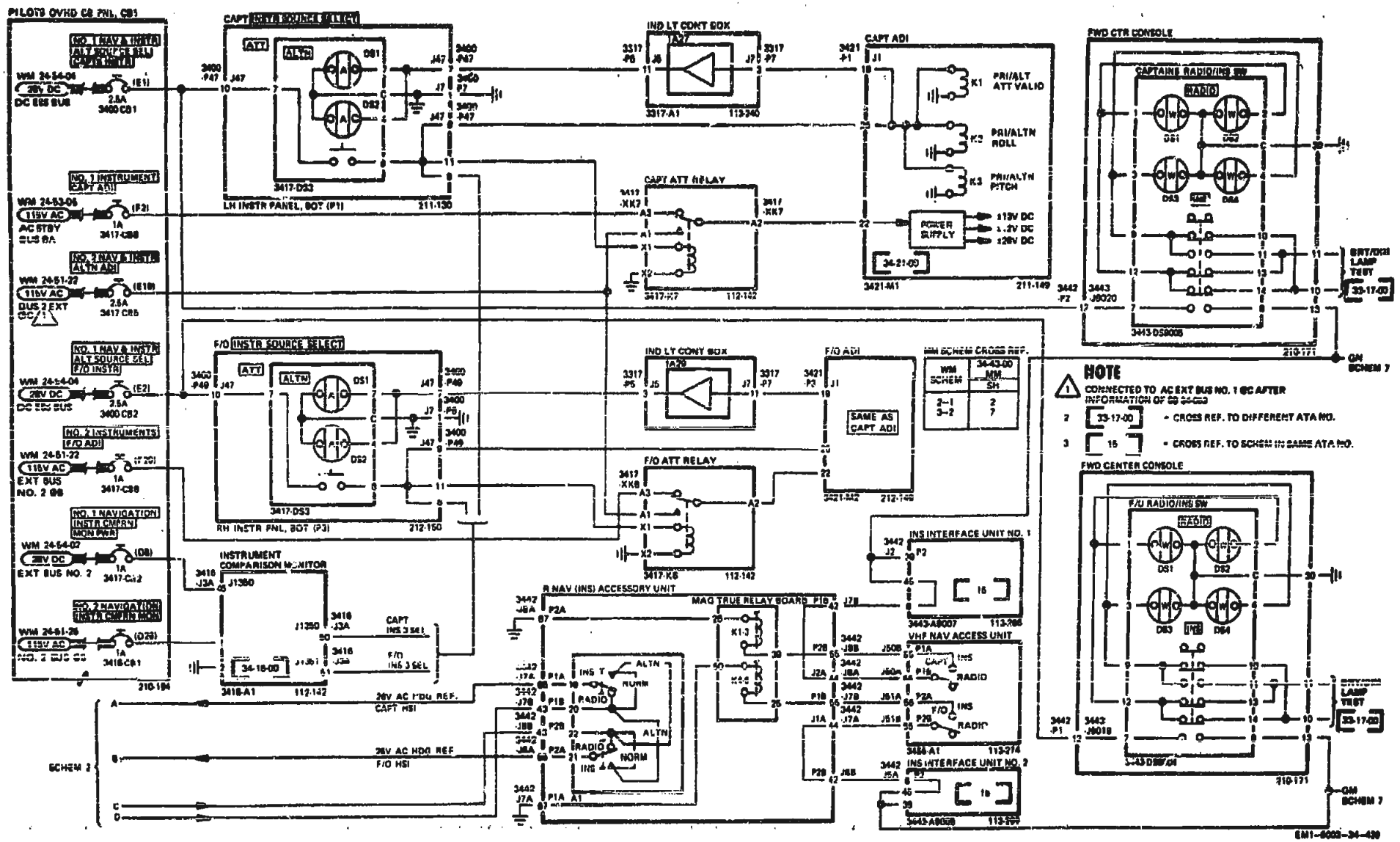
C Inertial Navigation System Intercabling Schematic (Interface)
C SCHEM 1

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
006B



C No. 1, No. 2 and No. 3 INS Power and Attitude Excitation
C SCHEM 2

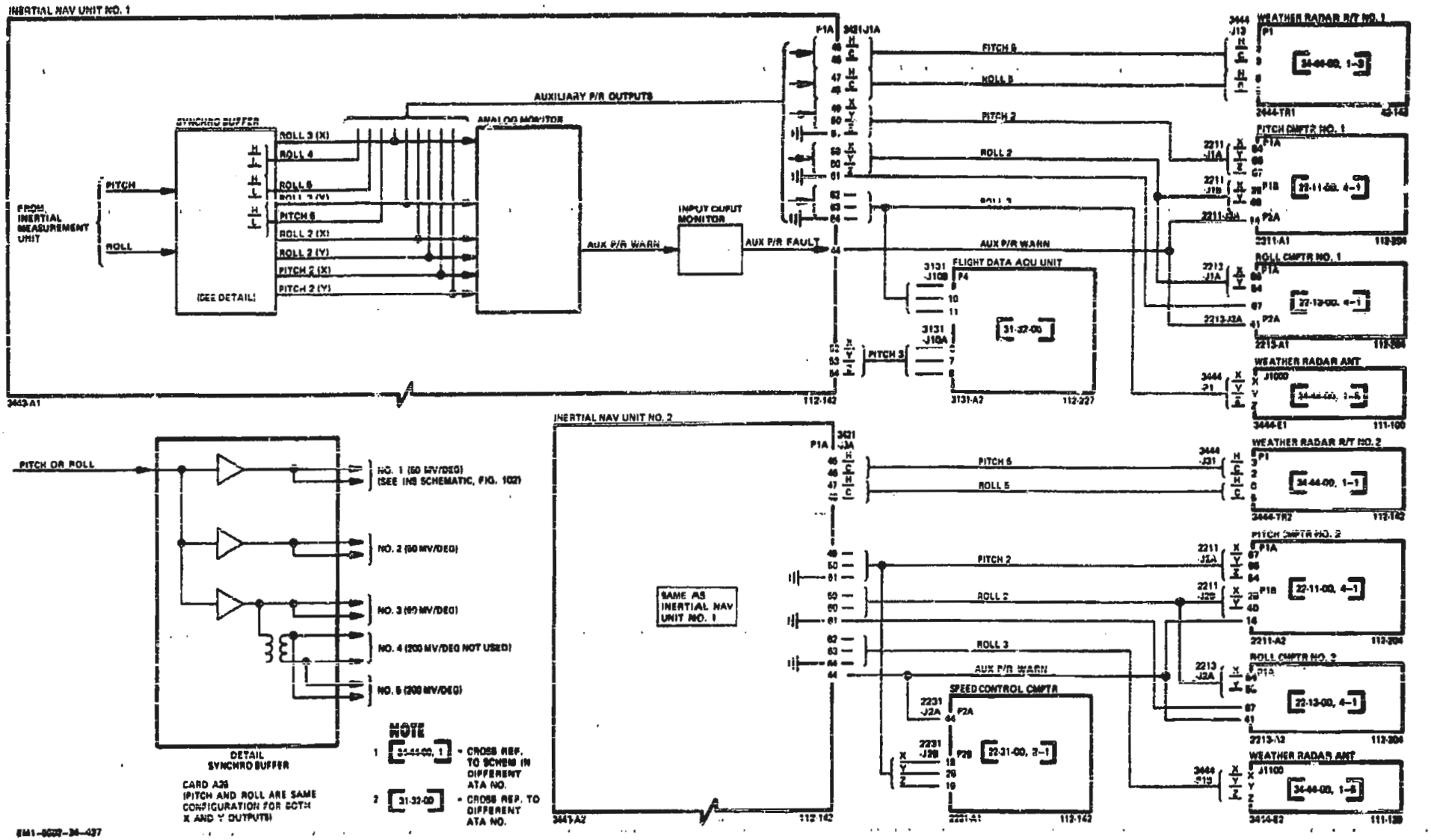
R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
006B


PILOTS OVHD CB PNL, CB1
CAPT INSTR SOURCE SELECT
IND LT CONT BOX
CAPT ADI
FWD CTR CONSOLE
CAPTAINS RADIO/INS SW
CAPT ATT RELAY
F/O INSTR SOURCE SELECT
F/O ADI
F/O ATT RELAY
SAME AS CAPT ADI
INSTRUMENT COMPARISON MONITOR
R NAV (INS) ACCESSORY UNIT
MAG TRUE RELAY BOARD
INS INTERFACE UNIT NO. 1
INS INTERFACE UNIT NO. 2
VHF NAV ACCESS UNIT
F/O CENTER CONSOLE
F/O RADIO/INS SW
LH INSTR PANEL, BOT (P1)
RH INSTR PNL, BOT (P3)
NOTE
CONNECTED TO AC EXT BUS NO. 1 CB AFTER INFORMATION OF CB 24-53
CROSS REF. TO DIFFERENT ATA NO.
CROSS REF. TO SCHEM IN SAME ATA NO.
ON SCHEM 7
SCHEM 2
SCHEM 3
EM1-6003-34-420

ADI Power; ATT ALTN and Radio/INS Select
SCHEM 3

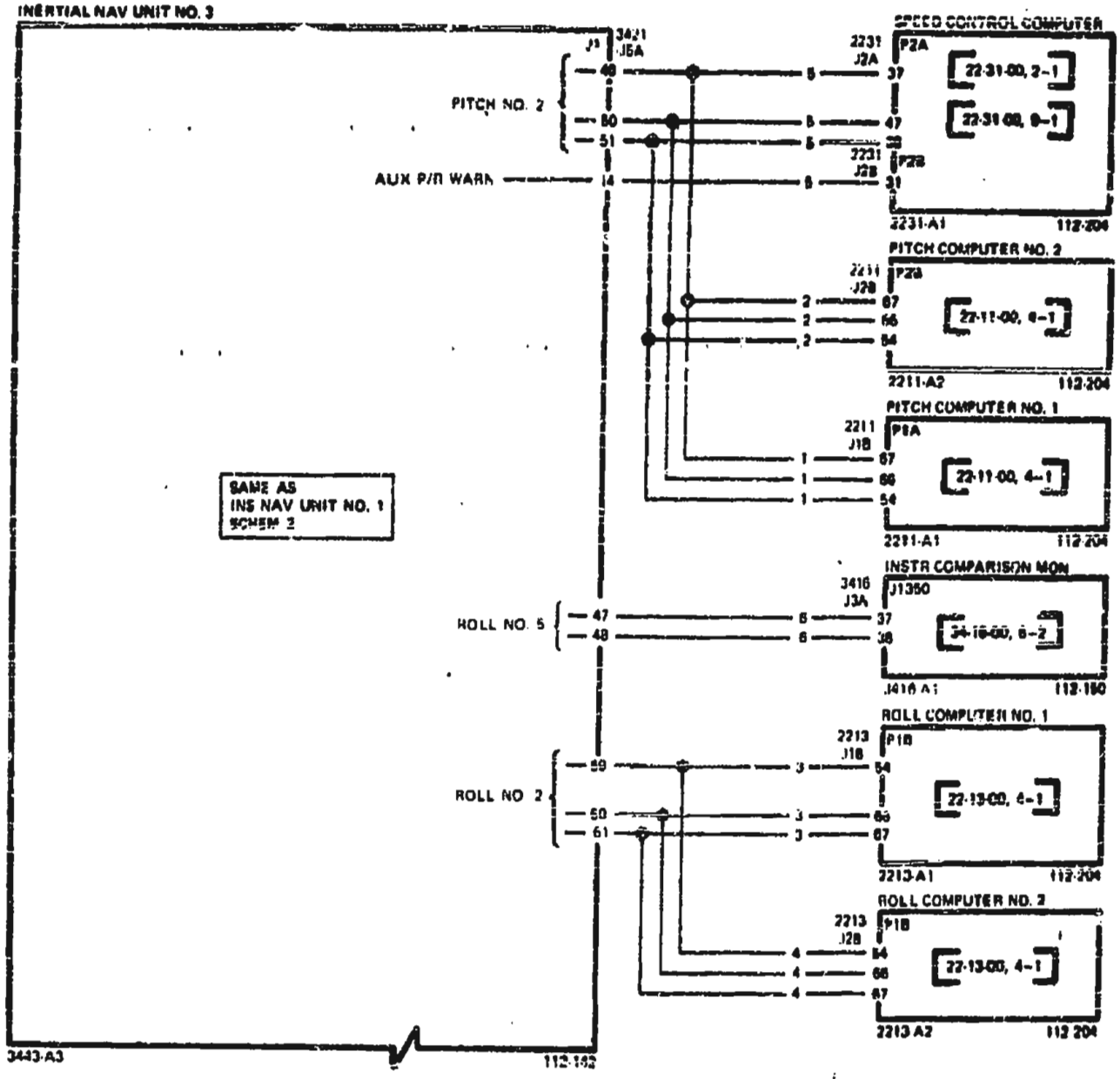
EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031

006B



No. 1 and No. 2 INS Attitude Outputs
SCHEM 4

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031



WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-04	1
3	22-13-03	1
4	22-13-04	
5	22-31-04	1
6	34-16-04	1

NOTE

1 [34-21-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

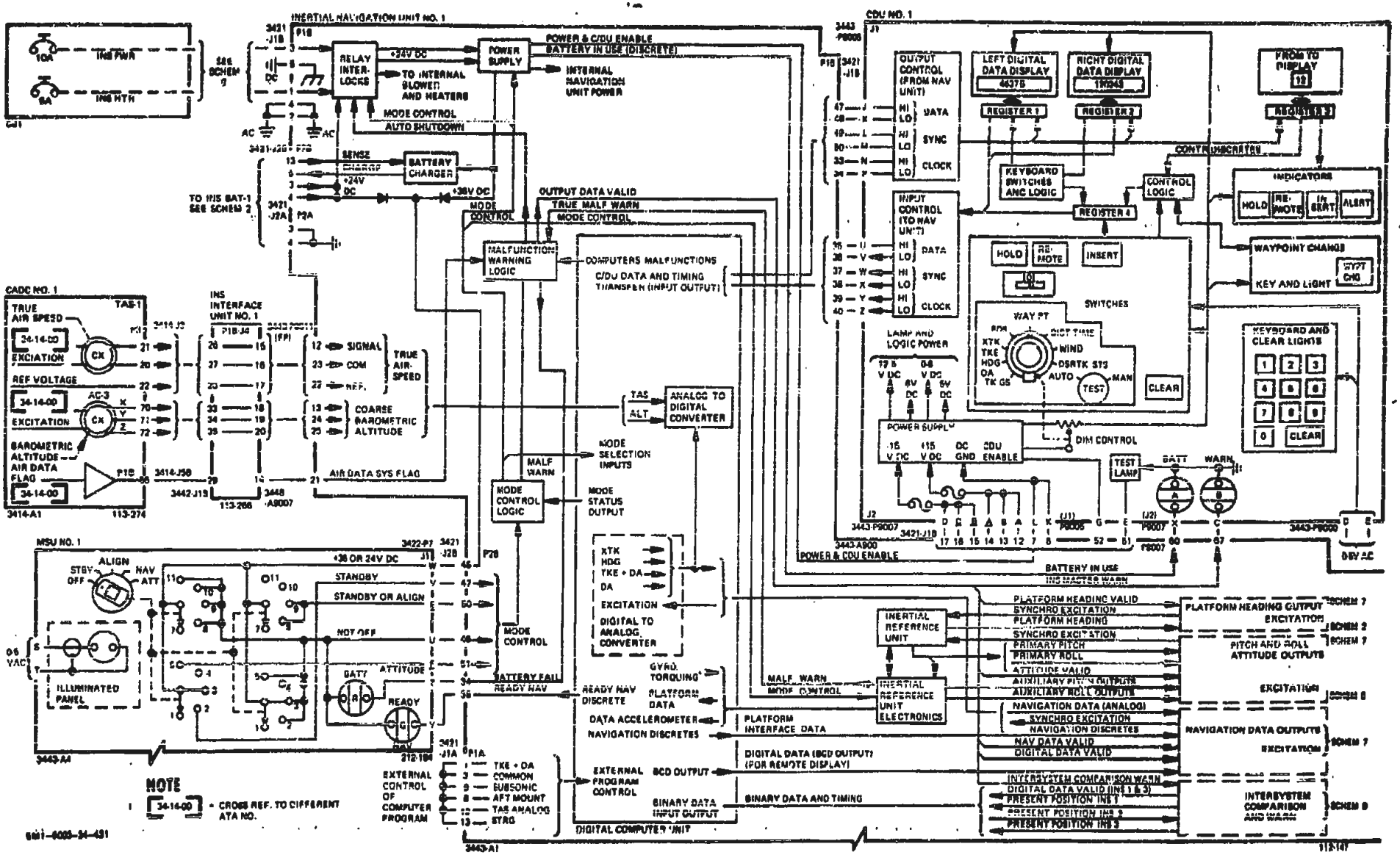
2 —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

EM1-0005 34-430

C
C

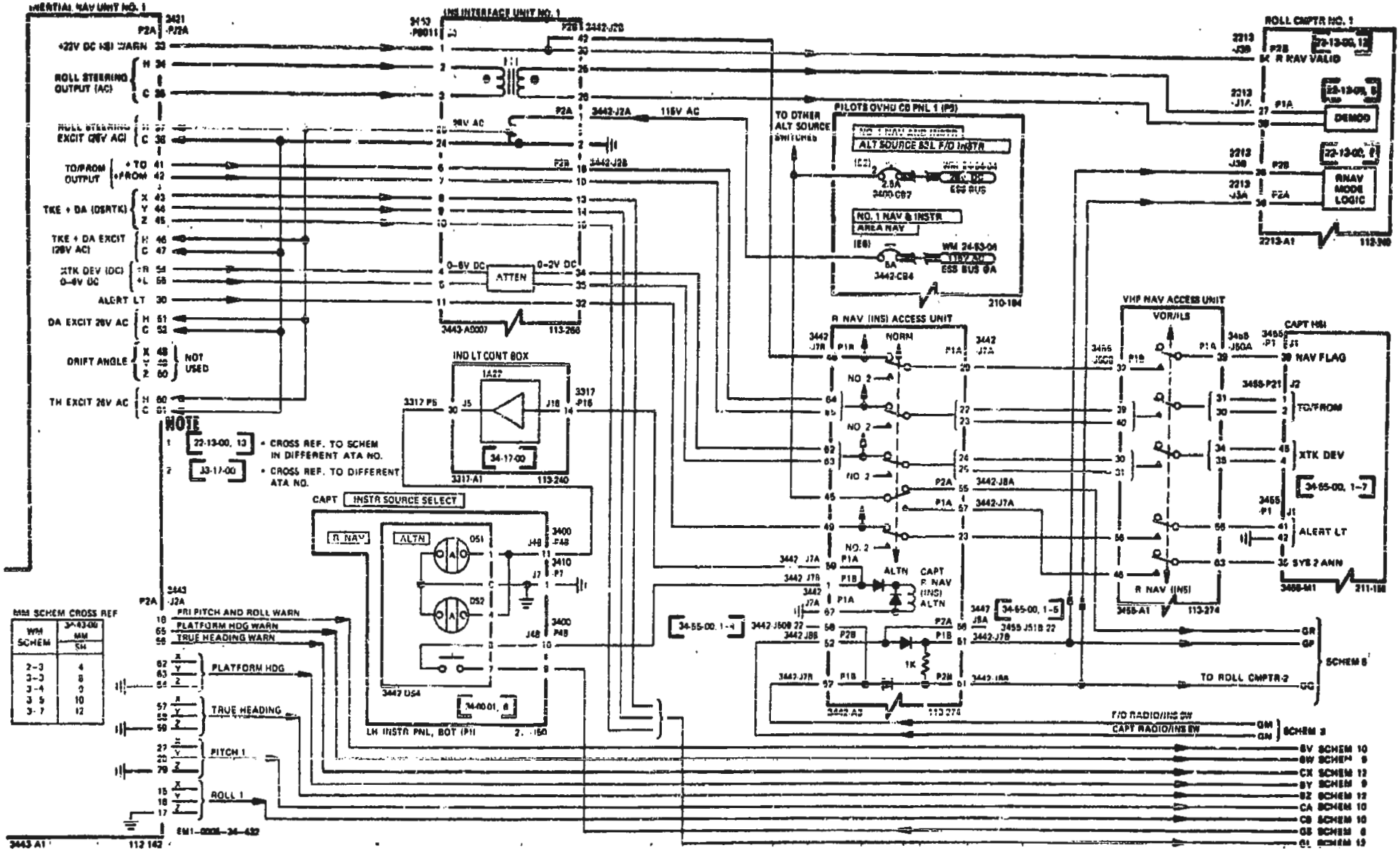
No. 3 INS Attitude Outputs
SCHEM 5

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
0058



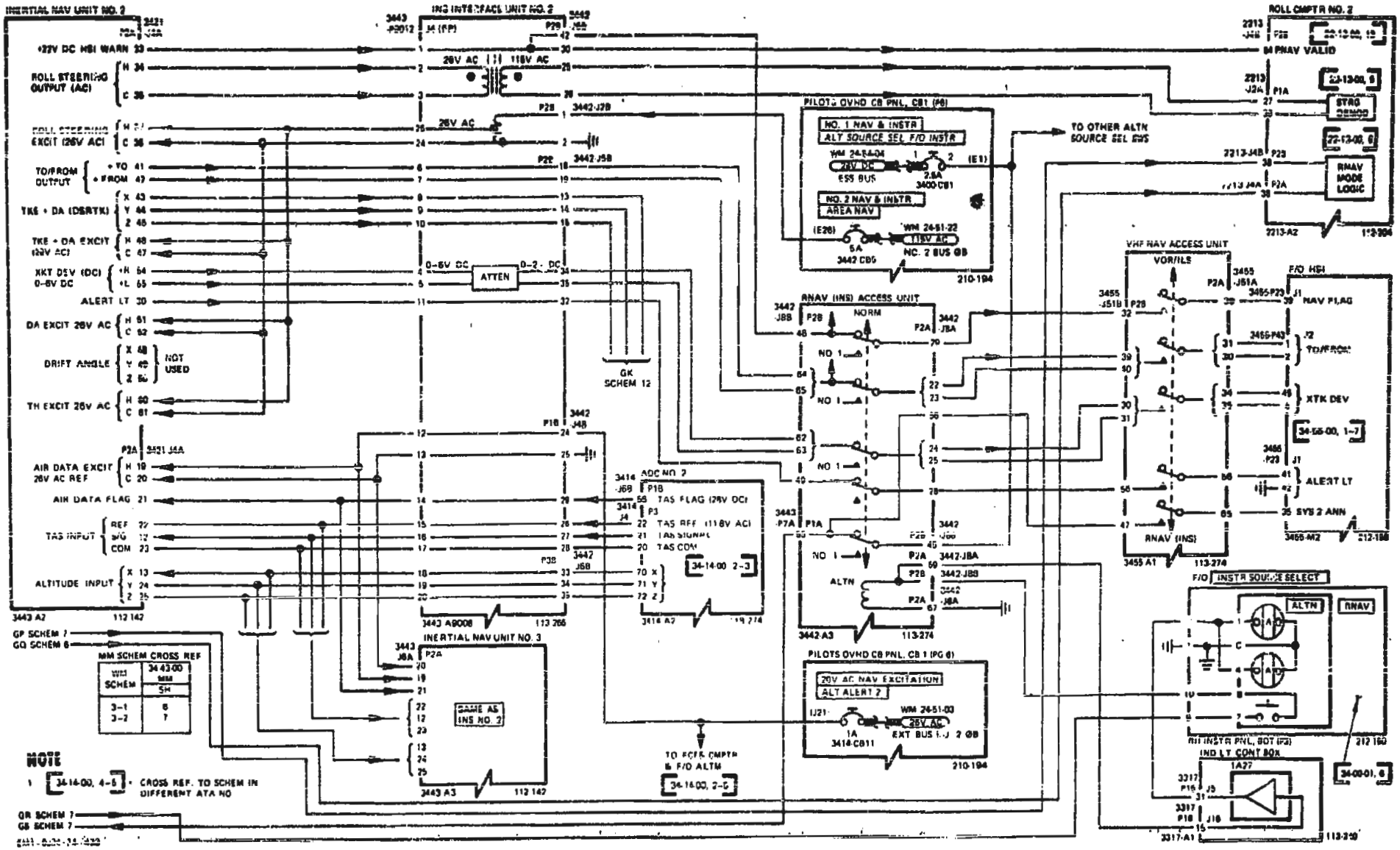
No. 1 INS Air Data Inputs and CDU/MSU Connections
SCHEM 6

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031



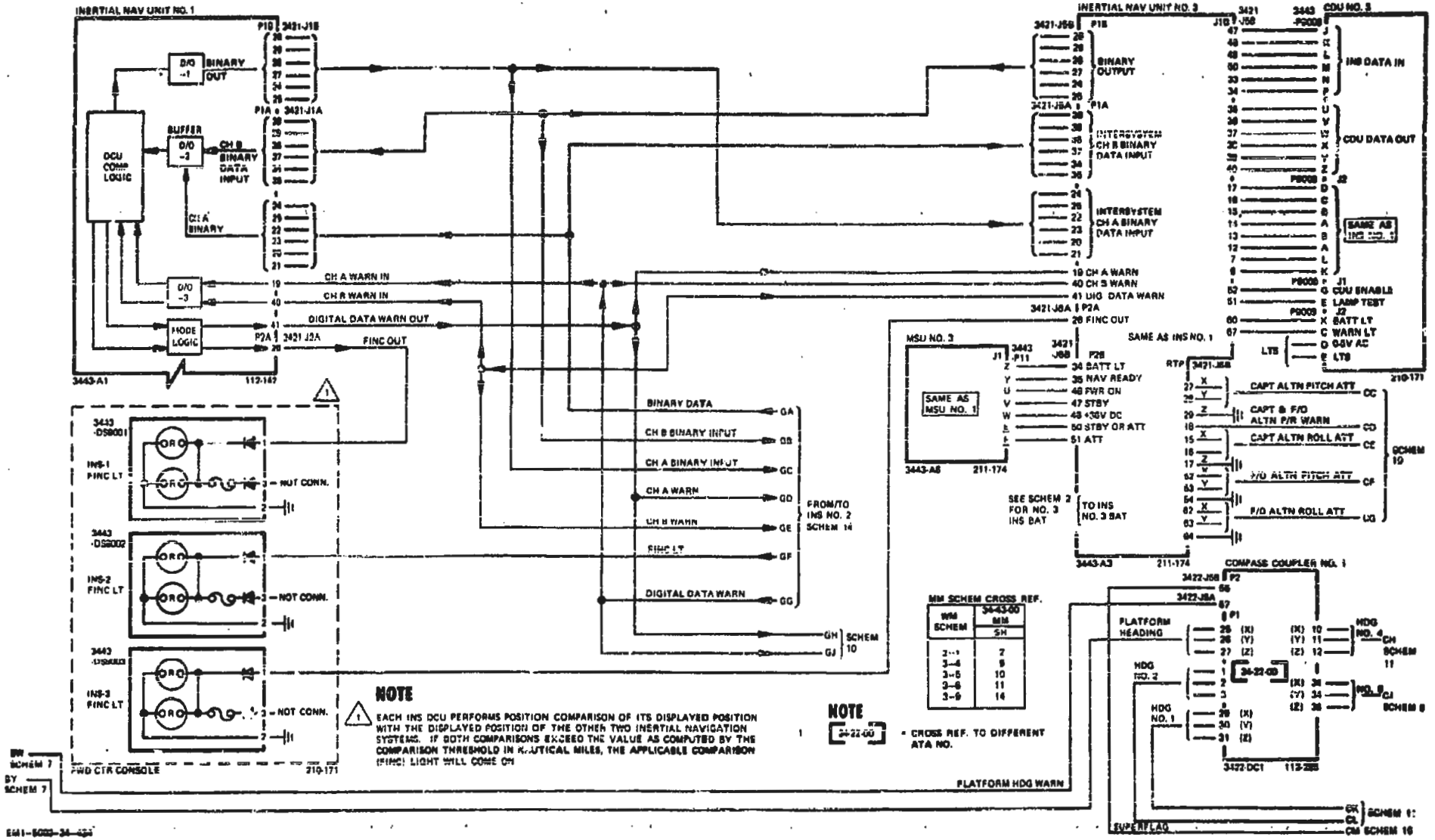
INS No. 1 ATT and NAV Outputs
SCHEM 7

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031



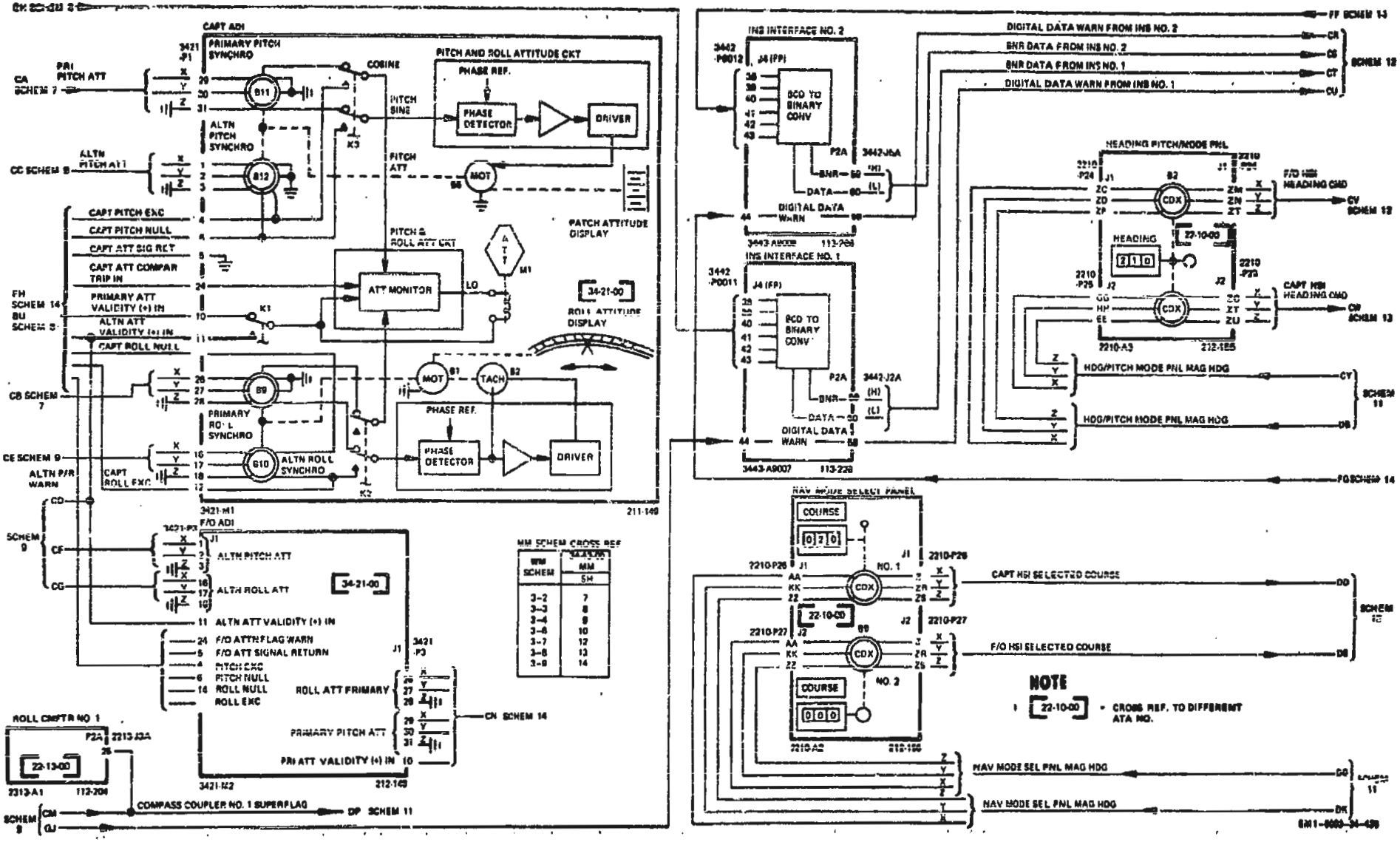
C INS No. 2 and No. 3 Air Data Inputs and Nav Outputs
C SCHEM 8

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
006B


INERTIAL NAV UNIT NO. 1
INERTIAL NAV UNIT NO. 3
CDU NO. 3
MSU NO. 3
BINARY OUTPUT
INTERSYSTEM CH B BINARY DATA INPUT
INTERSYSTEM CH A BINARY DATA INPUT
INS DATA IN
CDU DATA OUT
SAME AS INS NO. 1
CH A WARN IN
CH B WARN IN
DIGITAL DATA WARN OUT
FINC OUT
BINARY DATA
CH B BINARY INPUT
CH A BINARY INPUT
CH A WARN
CH B WARN
FINC LT
DIGITAL DATA WARN
FROM/TO INS NO. 2 SCHEM 14
SCHEM 10
CAPT ALTN PITCH ATT
CAPT & F/O ALTN P/R WARN
CAPT ALTN ROLL ATT
F/O ALTN PITCH ATT
F/O ALTN ROLL ATT
SEE SCHEM 2 FOR NO. 3 INS BAT
TO INS NO. 3 BAT
COMPASS COUPLER NO. 1
PLATFORM HEADING
HDG NO. 1
HDG NO. 2
HDG NO. 4
SCHEM 11
SCHEM 8
SCHEM 12
SCHEM 16
PLATFORM HDG WARN
SUPERFLAG
NOT CONN.
FWD CTR CONSOLE
NOTE
EACH INS DCU PERFORMS POSITION COMPARISON OF ITS DISPLAYED POSITION WITH THE DISPLAYED POSITION OF THE OTHER TWO INERTIAL NAVIGATION SYSTEMS. IF BOTH COMPARISONS EXCEED THE VALUE AS COMPUTED BY THE COMPARISON THRESHOLD IN NAUTICAL MILES, THE APPLICABLE COMPARISON (FINC) LIGHT WILL COME ON
NOTE
* CROSS REF. TO DIFFERENT ATA NO.
MM SCHEM CROSS REF.

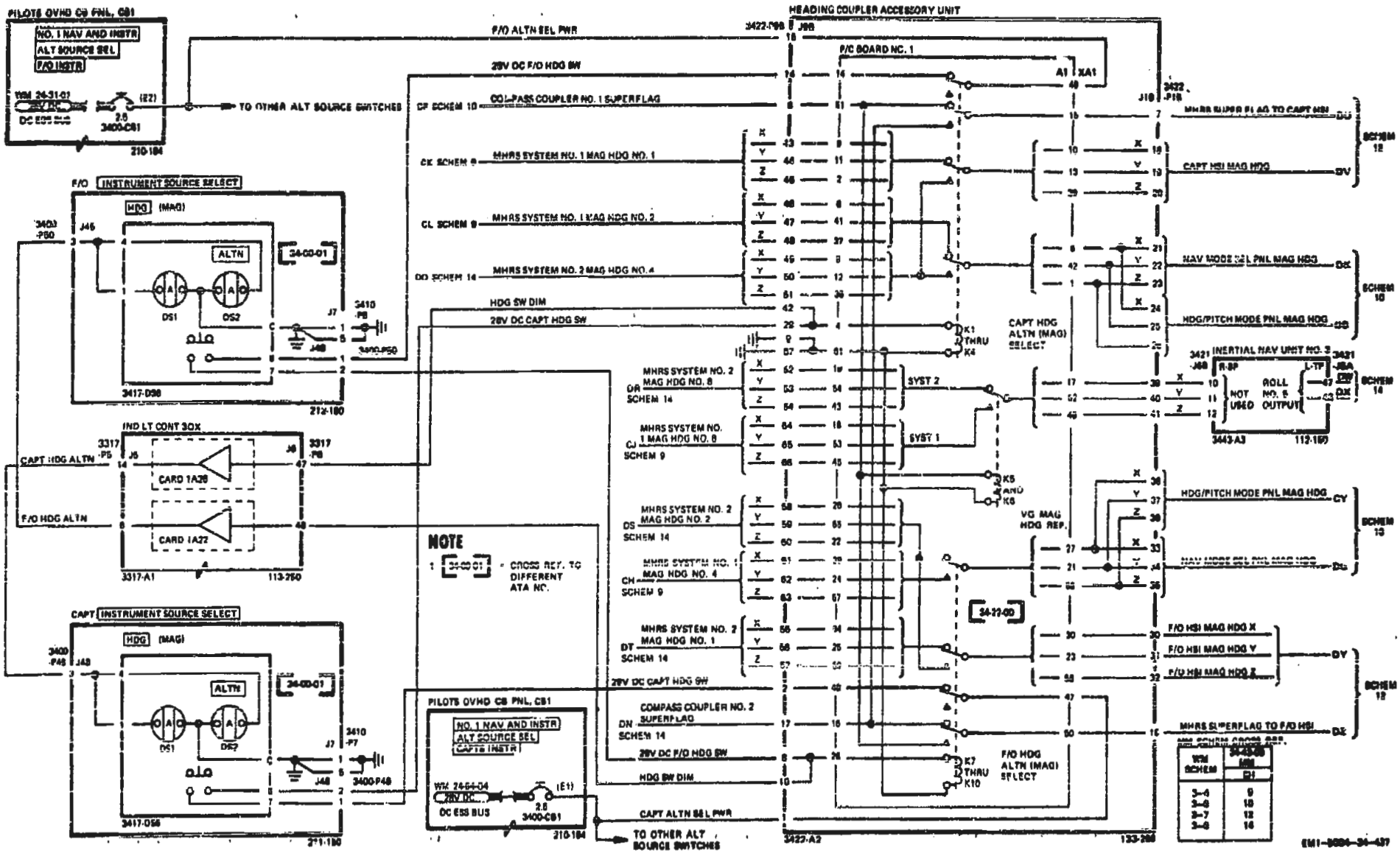
C No. 3 INS CDU/MSU; No. 1, No. 2 and No. 3 INS Comparison
C SCHEM 9

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
006B



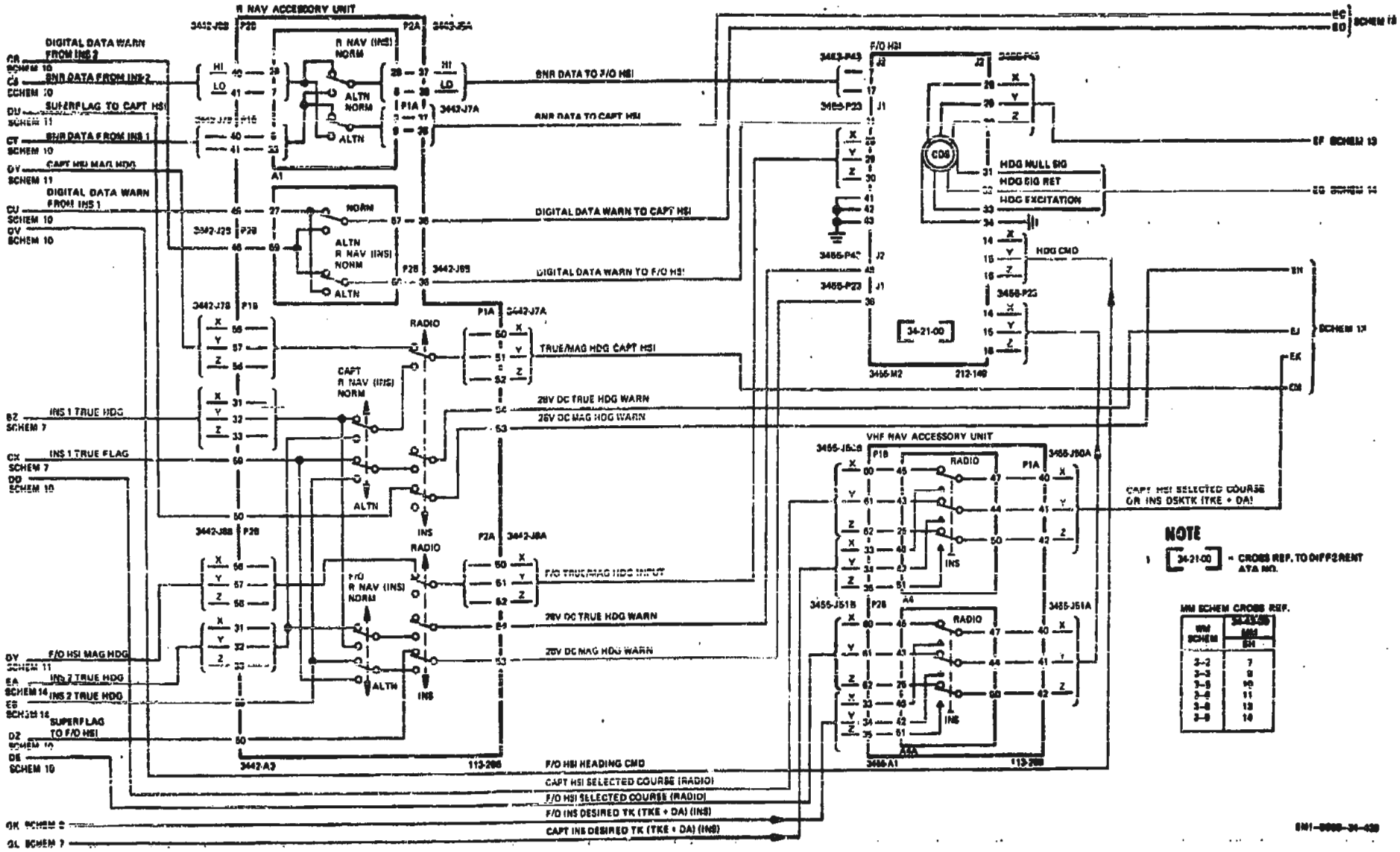
C C Capt and F/O ADI; Mag Hdg and Course Select
SCHEM 10

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 051
006B


PILOTS OVHD CB PNL, CB1
NO. 1 NAV AND INSTR
ALT SOURCE SEL
F/O INSTR
TO OTHER ALT SOURCE SWITCHES
F/O INSTRUMENT SOURCE SELECT
HDG (MAG)
ALTN
DS1
DS2
CAPT INSTRUMENT SOURCE SELECT
IND LT CONT BOX
CARD 1A26
CARD 1A22
CAPT HDG ALTN
F/O HDG ALTN
HEADING COUPLER ACCESSORY UNIT
P/C BOARD NO. 1
F/O ALTN SEL PWR
28V DC F/O HDG SW
COMPASS COUPLER NO. 1 SUPERFLAG
MHRS SYSTEM NO. 1 MAG HDG NO. 1
MHRS SYSTEM NO. 1 MAG HDG NO. 2
MHRS SYSTEM NO. 2 MAG HDG NO. 4
HDG SW DIM
28V DC CAPT HDG SW
MHRS SYSTEM NO. 2 MAG HDG NO. 8
MHRS SYSTEM NO. 1 MAG HDG NO. 8
MHRS SYSTEM NO. 2 MAG HDG NO. 2
MHRS SYSTEM NO. 1 MAG HDG NO. 4
MHRS SYSTEM NO. 2 MAG HDG NO. 1
COMPASS COUPLER NO. 2 SUPERFLAG
28V DC F/O HDG SW
HDG SW DIM
CAPT ALTN SEL PWR
TO OTHER ALT SOURCE SWITCHES
CAPT HDG ALTN (MAG) SELECT
F/O HDG ALTN (MAG) SELECT
VG MAG HDG REF.
SYST 2
SYST 1
INERTIAL NAV UNIT NO. 2
ROLL NO. 5 OUTPUT
NOT USED
CAPT HSI MAG HDG
NAV MODE SEL PNL MAG HDG
HDG/PITCH MODE PNL MAG HDG
F/O HSI MAG HDG X
F/O HSI MAG HDG Y
F/O HSI MAG HDG Z
MHRS SUPERFLAG TO F/O HSI
NOTE
1 34-00-01 - CROSS REF. TO DIFFERENT ATA NO.

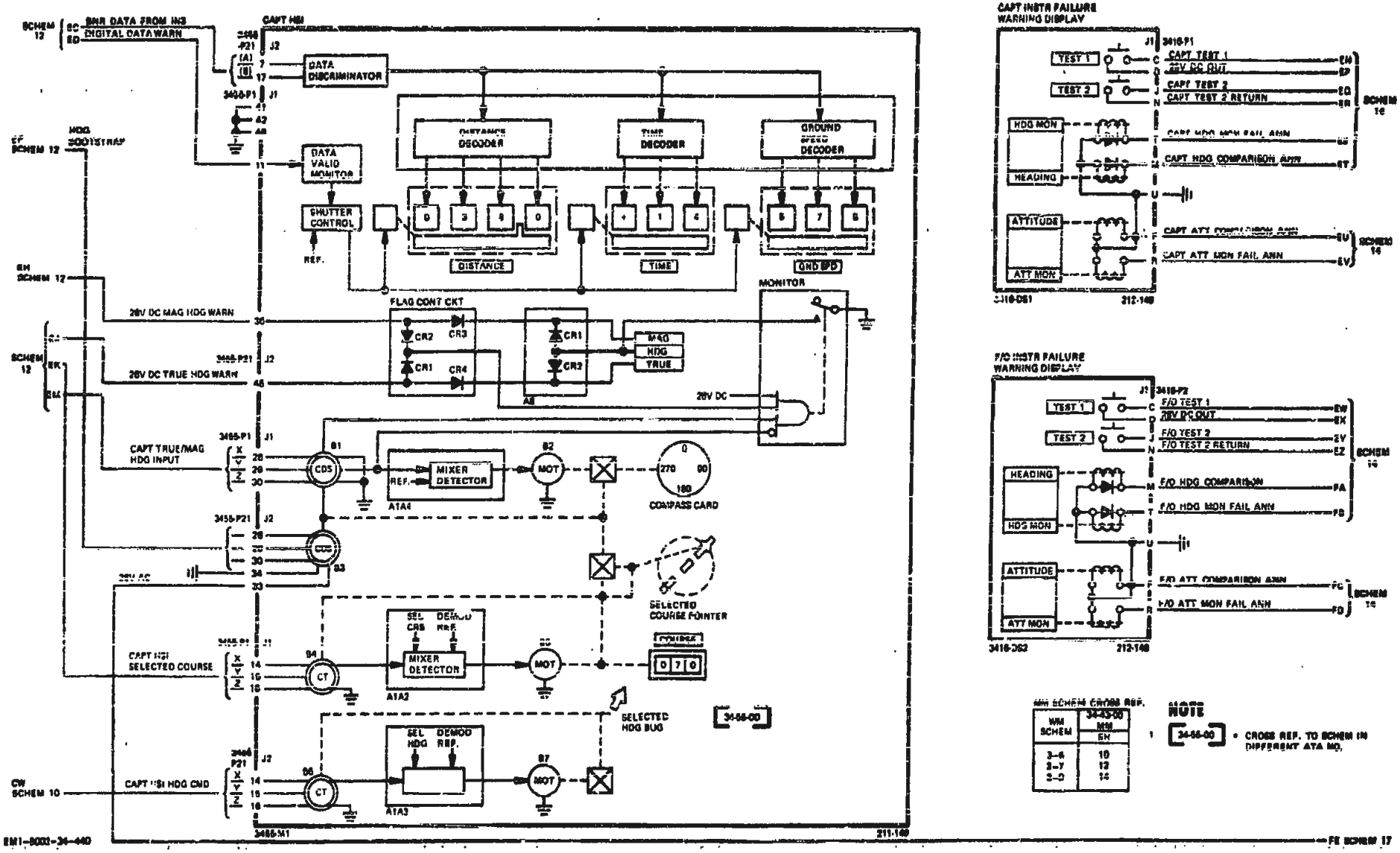
ALTN Mag Hdg Select and Switching
SCHEM 11

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031


R NAV ACCESSORY UNIT
DIGITAL DATA WARN FROM INS 2
SNR DATA FROM INS 2
SUPERFLAG TO CAPT HSI
SNR DATA FROM INS 1
CAPT HSI MAG HDG
DIGITAL DATA WARN FROM INS 1
R NAV (INS) NORM
ALTN NORM
ALTN
SNR DATA TO F/O HSI
SNR DATA TO CAPT HSI
DIGITAL DATA WARN TO CAPT HSI
DIGITAL DATA WARN TO F/O HSI
F/O HSI
HDG NULL SIG
HDG SIG RET
HDG EXCITATION
HDG CMD
RADIO
CAPT R NAV (IRS) NORM
TRUE/MAG HDG CAPT HSI
28V DC TRUE HDG WARN
28V DC MAG HDG WARN
INS 1 TRUE HDG
INS 1 TRUE FLAG
ALTN
INS
F/O R NAV (INS) NORM
F/O TRUE/MAG HDG INPUT
F/O HSI MAG HDG
INS 2 TRUE HDG
SUPERFLAG TO F/O HSI
VHF NAV ACCESSORY UNIT
CAPT HSI SELECTED COURSE OR INS DSKTK (TKE + DA)
NOTE
1 [34-21-00] = CROSS REF. TO DIFFERENT ATA NO.
VM SCHEM CROSS REF.
F/O HDG HEADING CMD
CAPT HSI SELECTED COURSE (RADIO)
F/O HSI SELECTED COURSE (RADIO)
F/O INS DESIRED TK (TKE + DA) (INS)
CAPT INS DESIRED TK (TKE + DA) (INS)

C RNAV (INS) ALTN and Radio/INS Switching
C SCHEM 12

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
006B

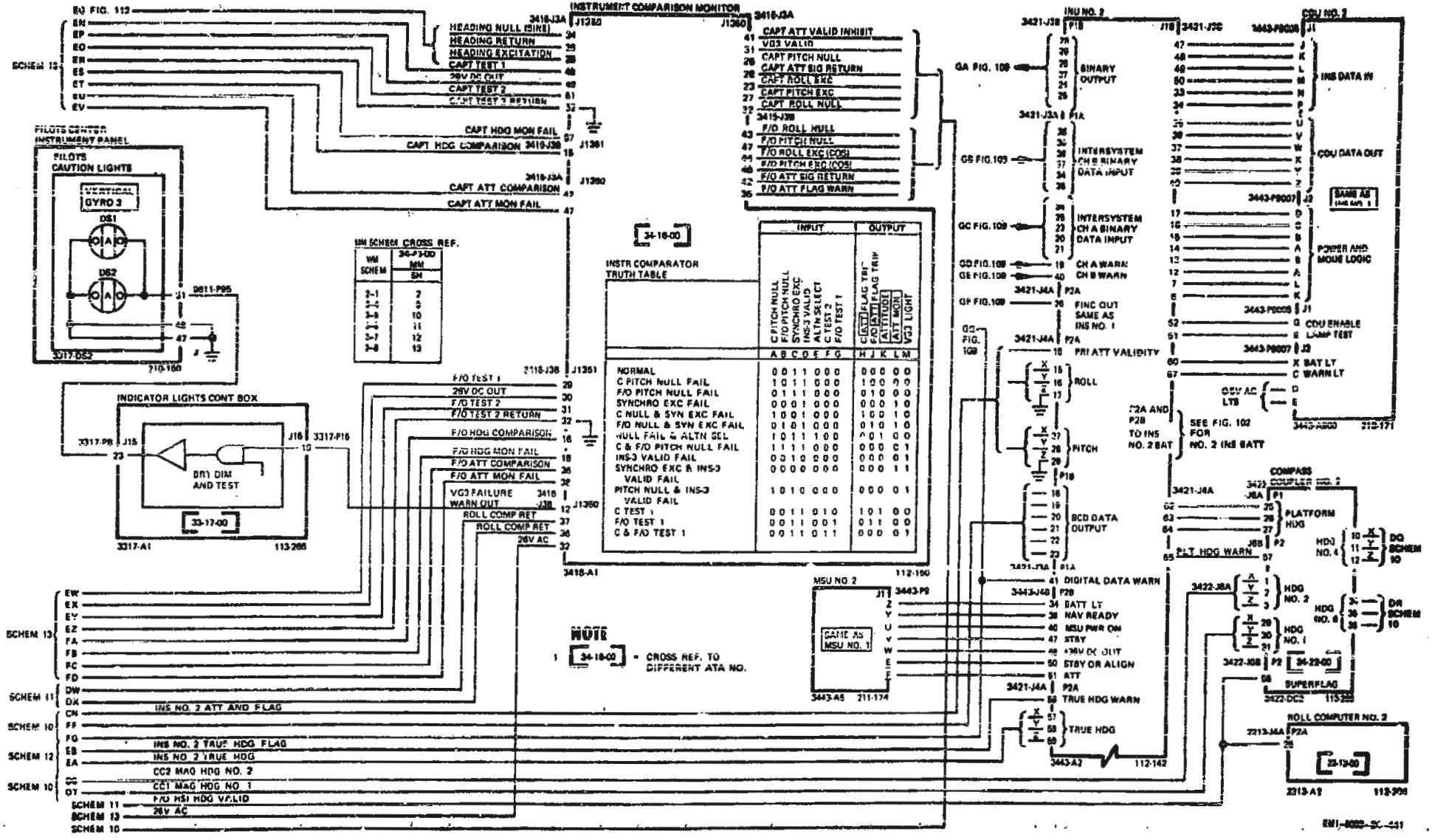


WM SCHEM	34-43-00 MM	34-43-00 EM
3-6	10	
3-7	12	
3-9	14	

NOTE
34-56-00 • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

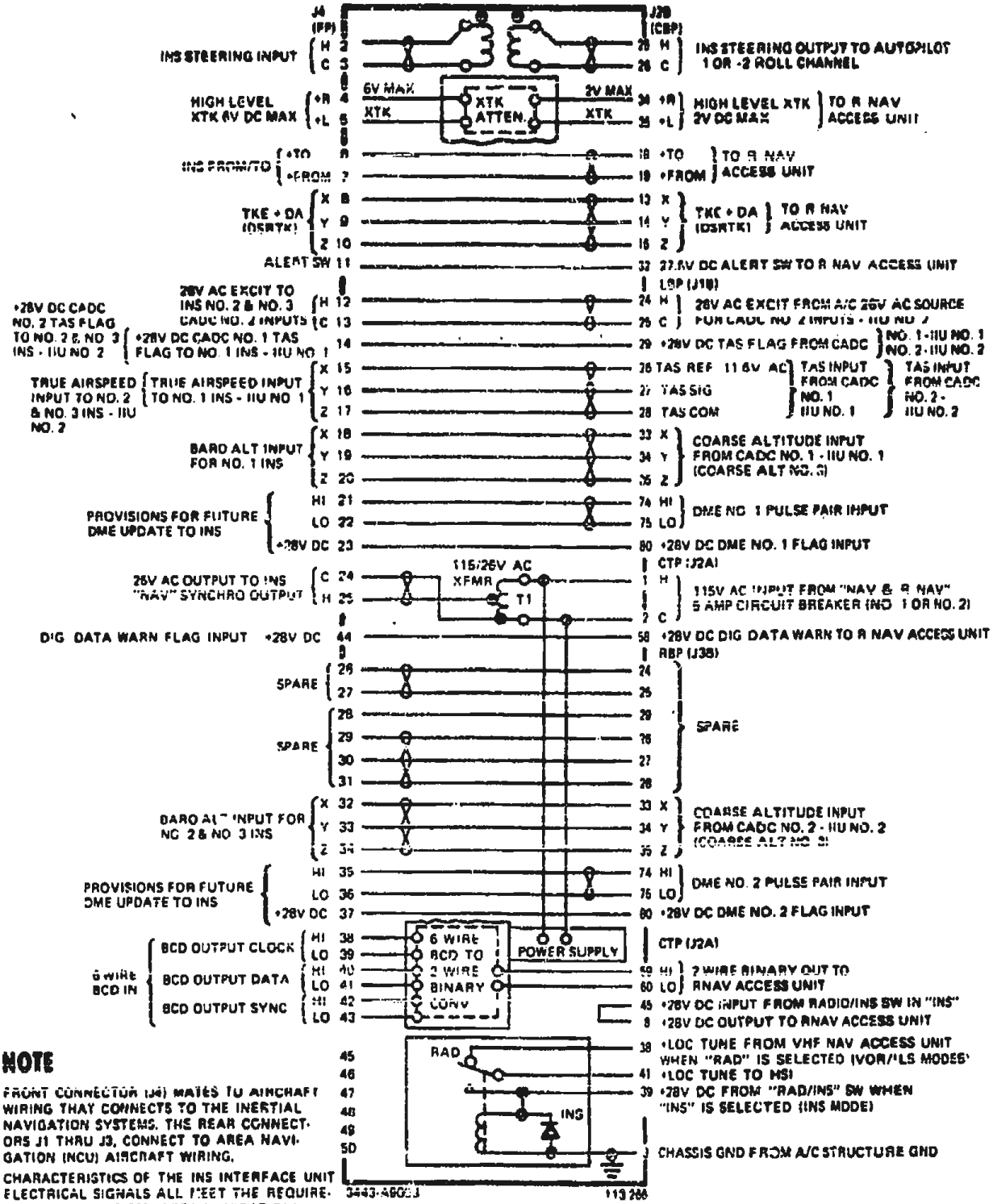
C Capt HSI, HDG and ATT Instr Warn Display
C SCHEM 13

R EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031
R
0068


INSTRUMENT COMPARISON MONITOR
INSTR COMPARATOR TRUTH TABLE
INPUT
OUTPUT
NORMAL
C PITCH NULL FAIL
F/O PITCH NULL FAIL
SYNCHRO EXC FAIL
C NULL & SYN EXC FAIL
F/O NULL & SYN EXC FAIL
NULL FAIL & ALTN SEL
C & F/O PITCH NULL FAIL
INS-3 VALID FAIL
SYNCHRO EXC & INS-3 VALID FAIL
PITCH NULL & INS-3 VALID FAIL
C TEST 1
F/O TEST 1
C & F/O TEST 1
INU NO. 2
CDU NO. 2
MSU NO. 2
COMPASS COUPLER NO. 2
ROLL COMPUTER NO. 2
PILOTS CENTER INSTRUMENT PANEL
PILOTS CAUTION LIGHTS
INDICATOR LIGHTS CONT BOX
DIM AND TEST
SAME AS MSU NO. 1
SEE FIG. 102 FOR NO. 2 INS BATT
NOTE
1 34-18-00 - CROSS REF. TO DIFFERENT ATA NO.

VG3 Lt; Instr Cmprsn Mon; No. 2 INS CDU/MSU
SCHEM 14

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031


J4 (FP)
J20 (CBP)
INS STEERING INPUT
INS STEERING OUTPUT TO AUTOPILOT 1 OR -2 ROLL CHANNEL
HIGH LEVEL XTK 6V DC MAX
6V MAX
XTK
XTK ATTEN.
2V MAX
HIGH LEVEL XTK 2V DC MAX
TO R NAV ACCESS UNIT
INS FROM/TO
TO R NAV ACCESS UNIT
TKE + DA (DSRTK)
ALERT SW
27.5V DC ALERT SW TO R NAV ACCESS UNIT
LBP (J19)
28V AC EXCIT TO INS NO. 2 & NO. 3
28V AC EXCIT FROM A/C 26V AC SOURCE FOR CADC NO. 2 INPUTS - IIU NO. 2
+28V DC CADC NO. 2 TAS FLAG TO NO. 2 & NO. 3 INS - IIU NO. 2
+28V DC CADC NO. 1 TAS FLAG TO NO. 1 INS - IIU NO. 1
+28V DC TAS FLAG FROM CADC
NO. 1 - IIU NO. 1
NO. 2 - IIU NO. 2
TRUE AIRSPEED INPUT TO NO. 2 & NO. 3 INS - IIU NO. 2
TRUE AIRSPEED INPUT TO NO. 1 INS - IIU NO. 1
TAS REF 11.6V AC
TAS SIG
TAS COM
TAS INPUT FROM CADC NO. 1 IIU NO. 1
TAS INPUT FROM CADC NO. 2 - IIU NO. 2
BARO ALT INPUT FOR NO. 1 INS
COARSE ALTITUDE INPUT FROM CADC NO. 1 - IIU NO. 1 (COARSE ALT NO. 3)
PROVISIONS FOR FUTURE DME UPDATE TO INS
HI
LO
+28V DC
DME NO. 1 PULSE PAIR INPUT
+28V DC DME NO. 1 FLAG INPUT
26V AC OUTPUT TO INS "NAV" SYNCHRO OUTPUT
115/26V AC XFMR T1
CTP (J2A)
115V AC INPUT FROM "NAV & R NAV" 5 AMP CIRCUIT BREAKER (NO. 1 OR NO. 2)
DIG DATA WARN FLAG INPUT +28V DC
+28V DC DIG DATA WARN TO R NAV ACCESS UNIT
RBP (J38)
SPARE
BARO ALT INPUT FOR NO. 2 & NO. 3 INS
COARSE ALTITUDE INPUT FROM CADC NO. 2 - IIU NO. 2 (COARSE ALT NO. 3)
PROVISIONS FOR FUTURE DME UPDATE TO INS
DME NO. 2 PULSE PAIR INPUT
+28V DC DME NO. 2 FLAG INPUT
6 WIRE BCD IN
BCD OUTPUT CLOCK
BCD OUTPUT DATA
BCD OUTPUT SYNC
6 WIRE BCD TO 2 WIRE BINARY CONV
POWER SUPPLY
CTP (J2A)
2 WIRE BINARY OUT TO RNAV ACCESS UNIT
+28V DC INPUT FROM RADIO/INS SW IN "INS"
+28V DC OUTPUT TO RNAV ACCESS UNIT
RAD
INS
+LOC TUNE FROM VHF NAV ACCESS UNIT WHEN "RAD" IS SELECTED (VOR/LLS MODES)
+LOC TUNE TO HSI
+28V DC FROM "RAD/INS" SW WHEN "INS" IS SELECTED (INS MODE)
CHASSIS GND FROM A/C STRUCTURE GND
3443-4803-3
113 288

NOTE

FRONT CONNECTOR (J4) MATES TO AIRCRAFT WIRING THAT CONNECTS TO THE INERTIAL NAVIGATION SYSTEMS. THE REAR CONNECTORS J1 THRU J3, CONNECT TO AREA NAVIGATION (RNU) AIRCRAFT WIRING.

CHARACTERISTICS OF THE INS INTERFACE UNIT ELECTRICAL SIGNALS ALL MEET THE REQUIREMENTS OF ARINC 582 (AREA NAVIGATION) AND ARINC 561 (INERTIAL NAVIGATION).

SCHEMATIC DESCRIBES UNIT WIRING AND ELECTRICAL REQUIREMENTS. THE INS INTERFACE UNIT, TWA PART NUMBER 801492-1

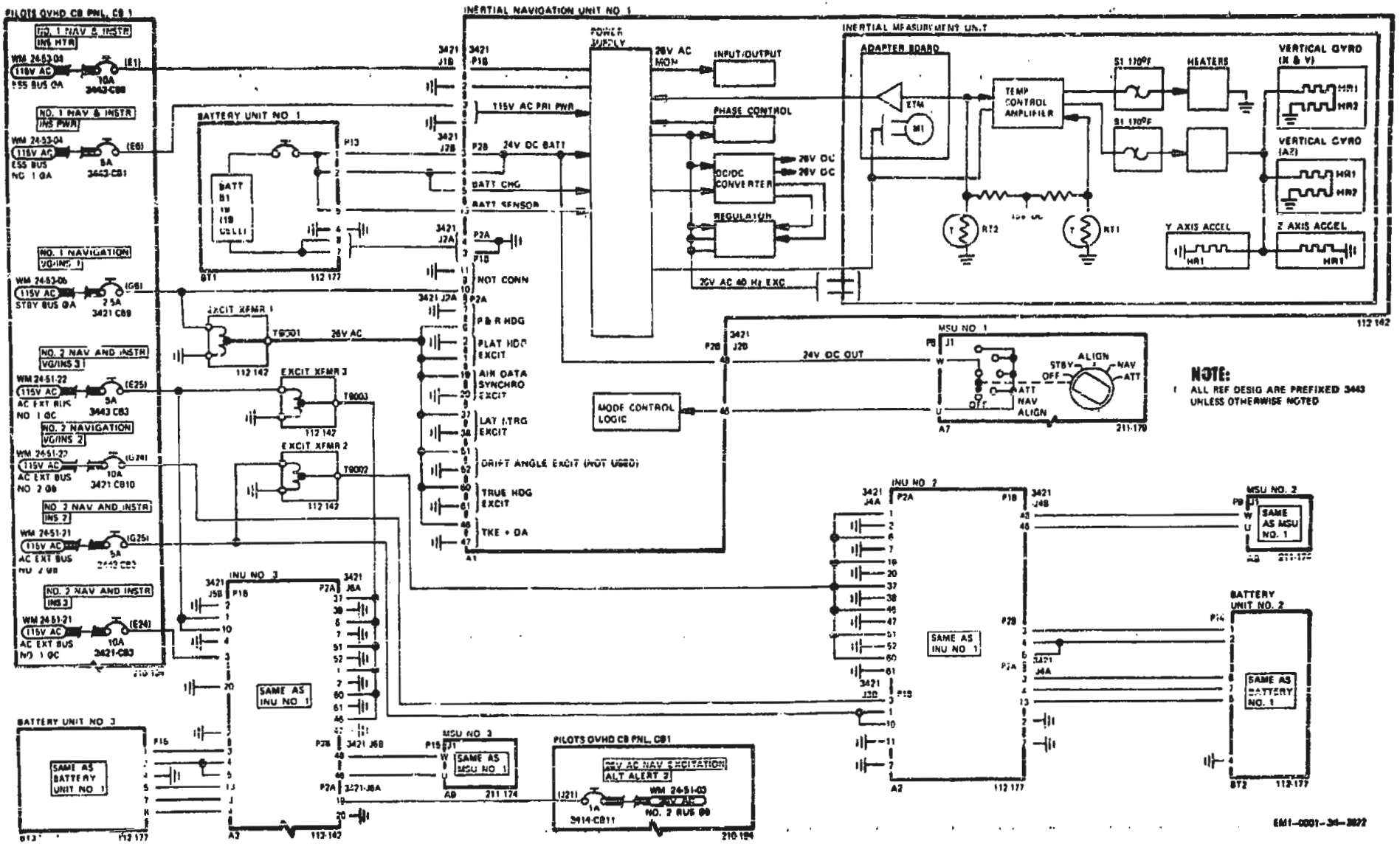
EM1-6002-34-442

C C

INS Interface Unit
SCHEM 15

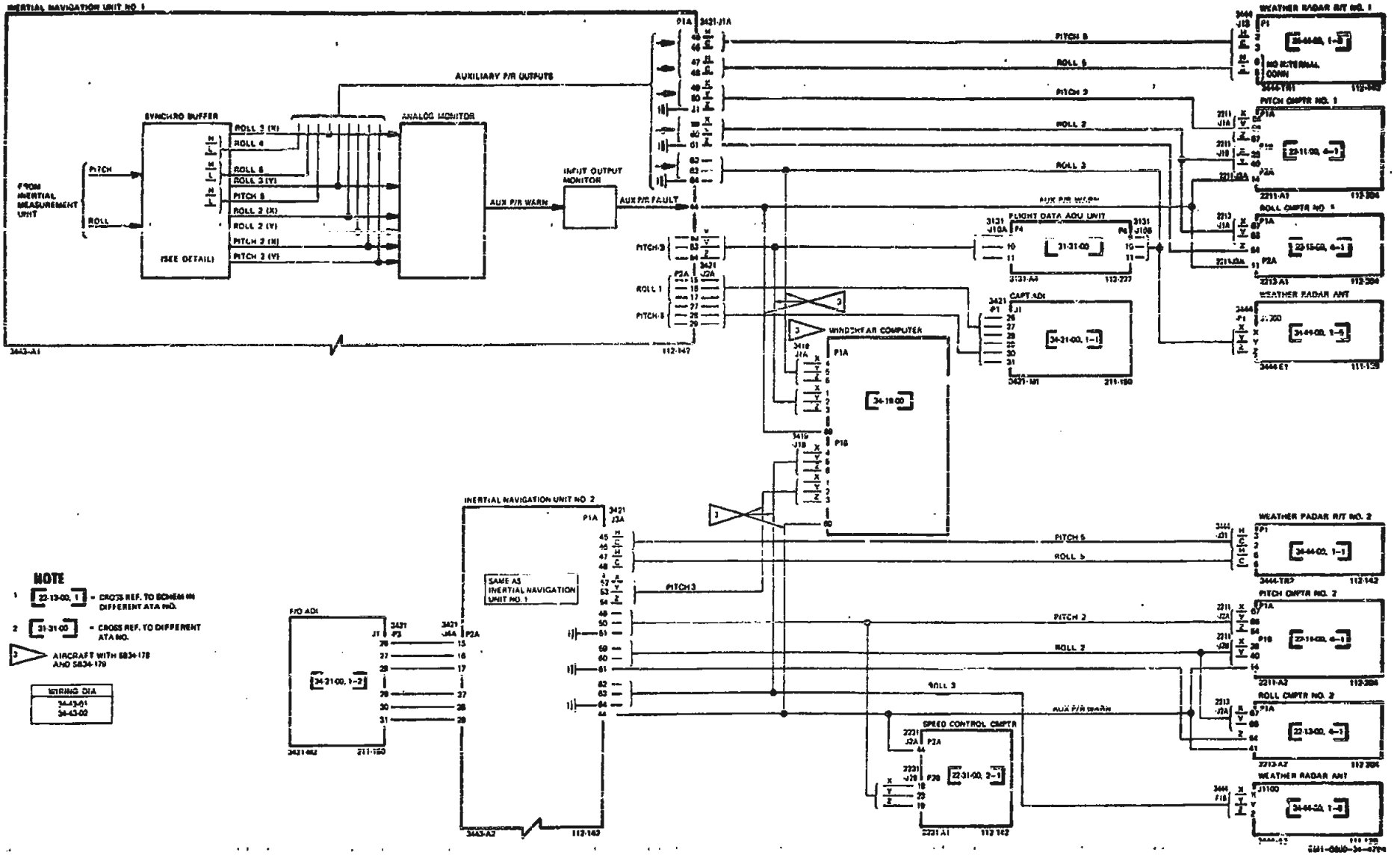
R R 006B

EFFECTIVITY: INS EQUIPPED AIRCRAFT THRU 031


PILOTS OVHD CB PNL, CB 1
NO. 1 NAV & INSTR INS HTR
NO. 1 NAV & INSTR INS PWR
NO. 1 NAVIGATION VG/INS 1
NO. 2 NAV AND INSTR VG/INS 3
NO. 2 NAVIGATION VG/INS 2
NO. 2 NAV AND INSTR INS 2
NO. 2 NAV AND INSTR INS 3
INERTIAL NAVIGATION UNIT NO. 1
POWER SUPPLY
INPUT/OUTPUT
PHASE CONTROL
DC/DC CONVERTER
REGULATION
MODE CONTROL LOGIC
INERTIAL MEASUREMENT UNIT
ADAPTER BOARD
TEMP CONTROL AMPLIFIER
HEATERS
VERTICAL GYRO (X & Y)
VERTICAL GYRO (AZ)
Y AXIS ACCEL
Z AXIS ACCEL
BATTERY UNIT NO. 1
EXCIT XFMR 1
EXCIT XFMR 3
EXCIT XFMR 2
INU NO. 3
INU NO. 2
MSU NO. 1
MSU NO. 2
MSU NO. 3
BATTERY UNIT NO. 2
BATTERY UNIT NO. 3
SAME AS INU NO. 1
SAME AS MSU NO. 1
SAME AS BATTERY UNIT NO. 1
SAME AS BATTERY NO. 1
PILOTS OVHD CB PNL, CB1
NOTE:
1 ALL REF DESIG ARE PREFIXED 3443 UNLESS OTHERWISE NOTED

Inertial Navigation System Schematic (No. 1, No. 2 and No. 3 INS Pwr and Excit)
SCHEM 1 (Sheet 1)

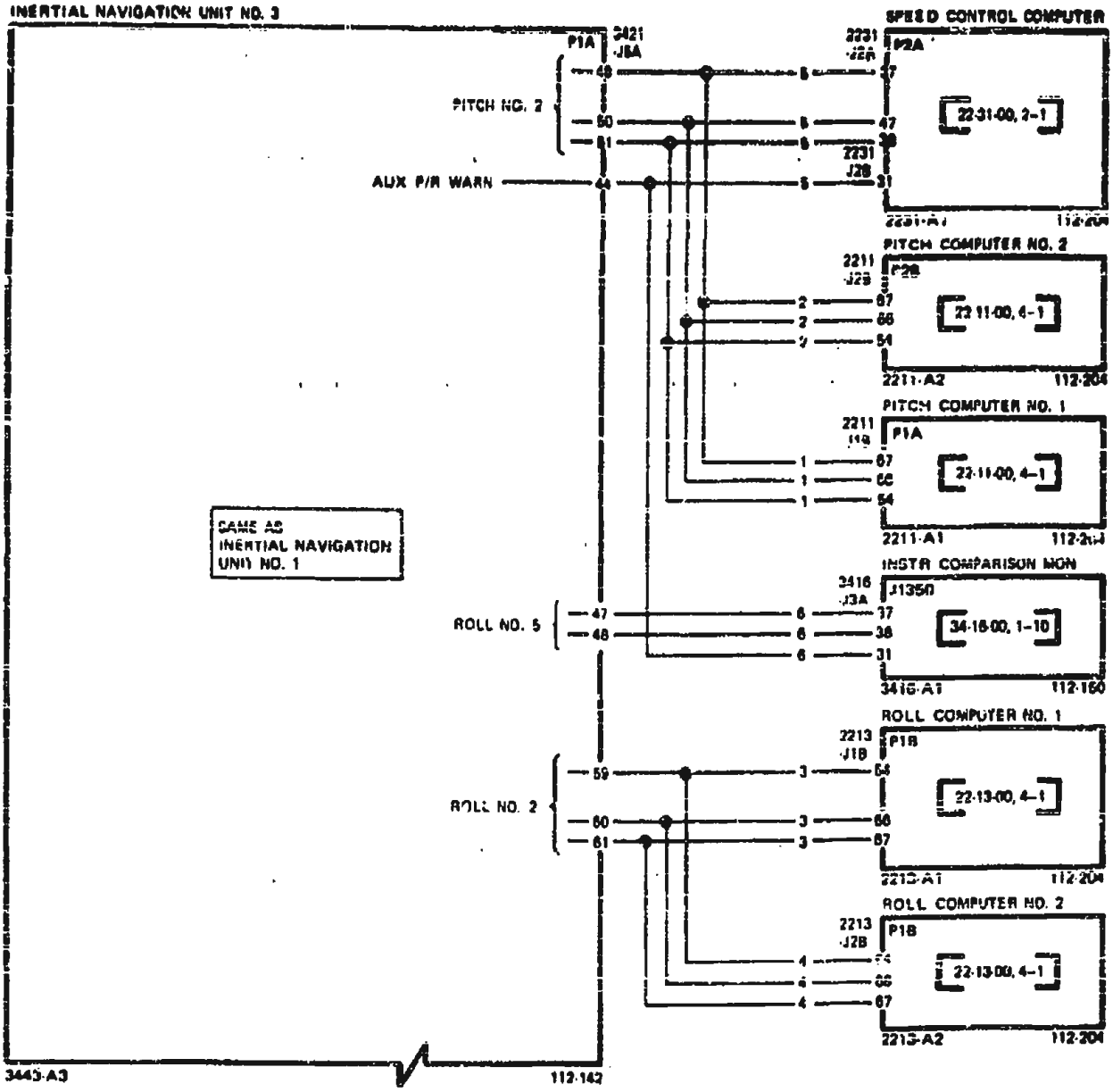
R EFFECTIVITY: 032-999
R
006B



R Inertial Navigation System Schematic (No. 1 and No. 2 Attitude
R Outputs)
R SCHEM 1 (Sheet 2)

EFFECTIVITY: 032-999

006B



WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-04	1
3	22-13-03	1
4	22-13-04	
5	22-31-04	1
6	34-16-04	1

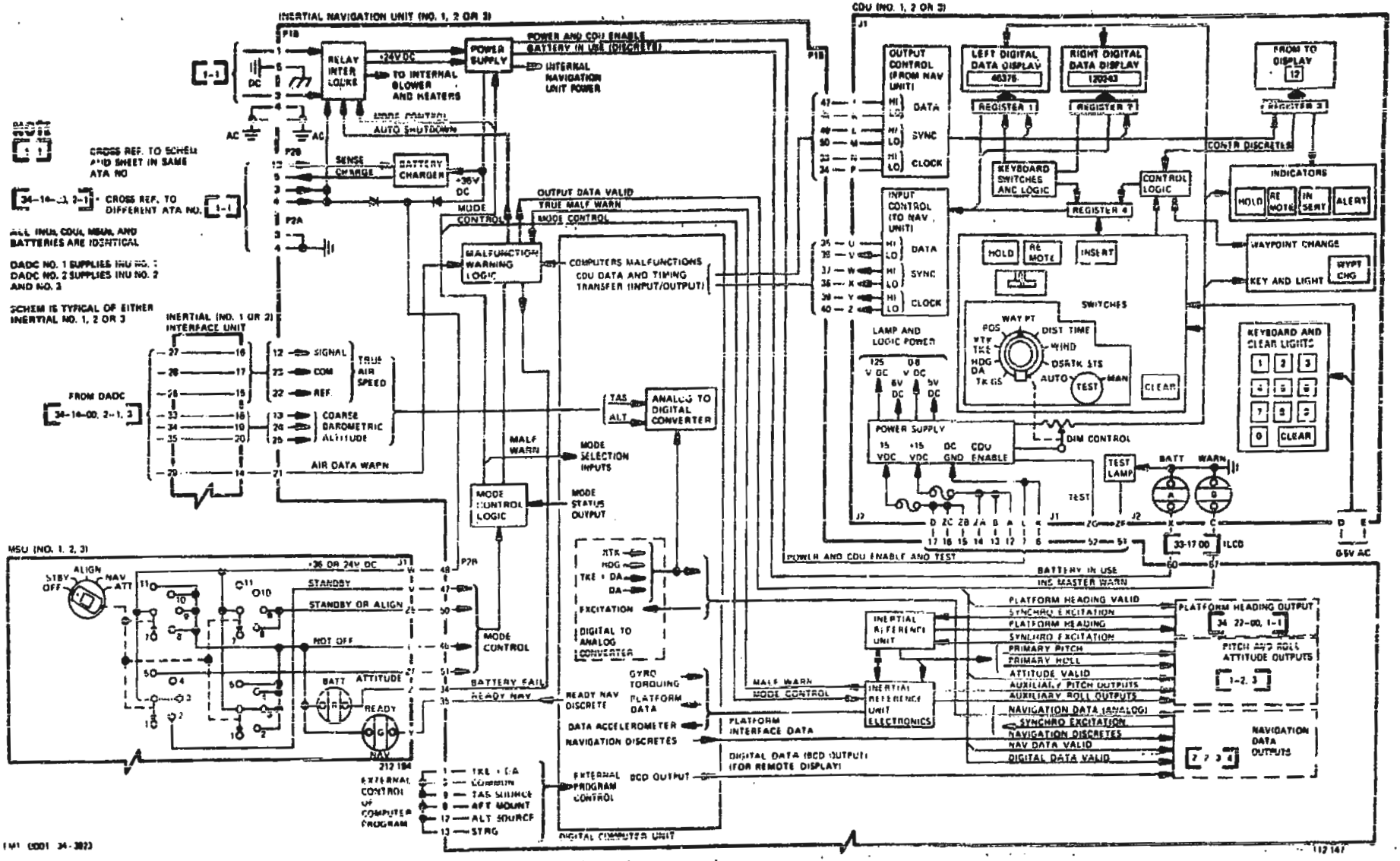
NOTE

1 [34-21-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

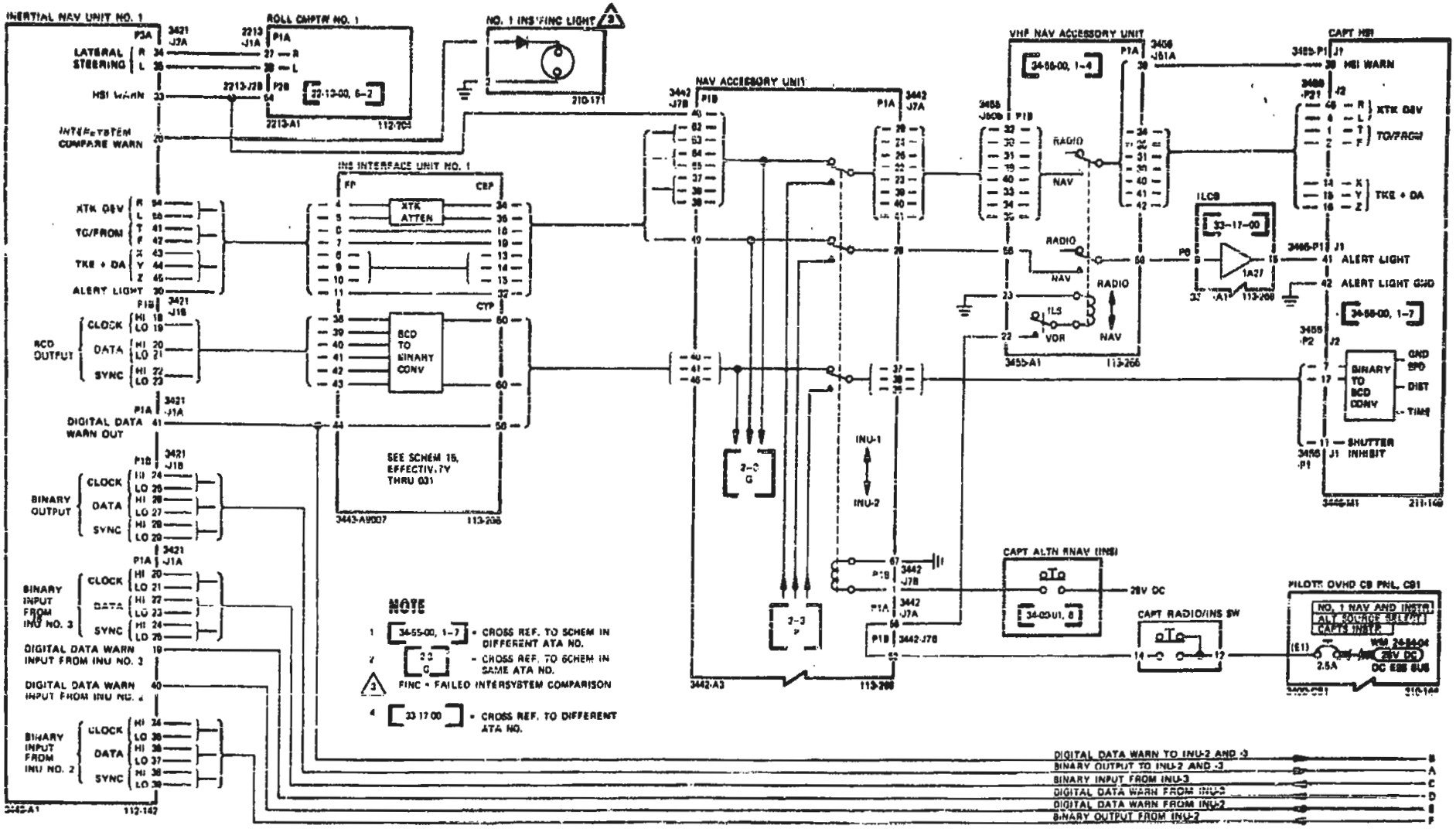
2 —— 4 —— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

EM1-0501-34-2431

Inertial Navigation System Schematic (No. 3 INS ATT Outputs)
SCHEM 1 (Sheet 3)

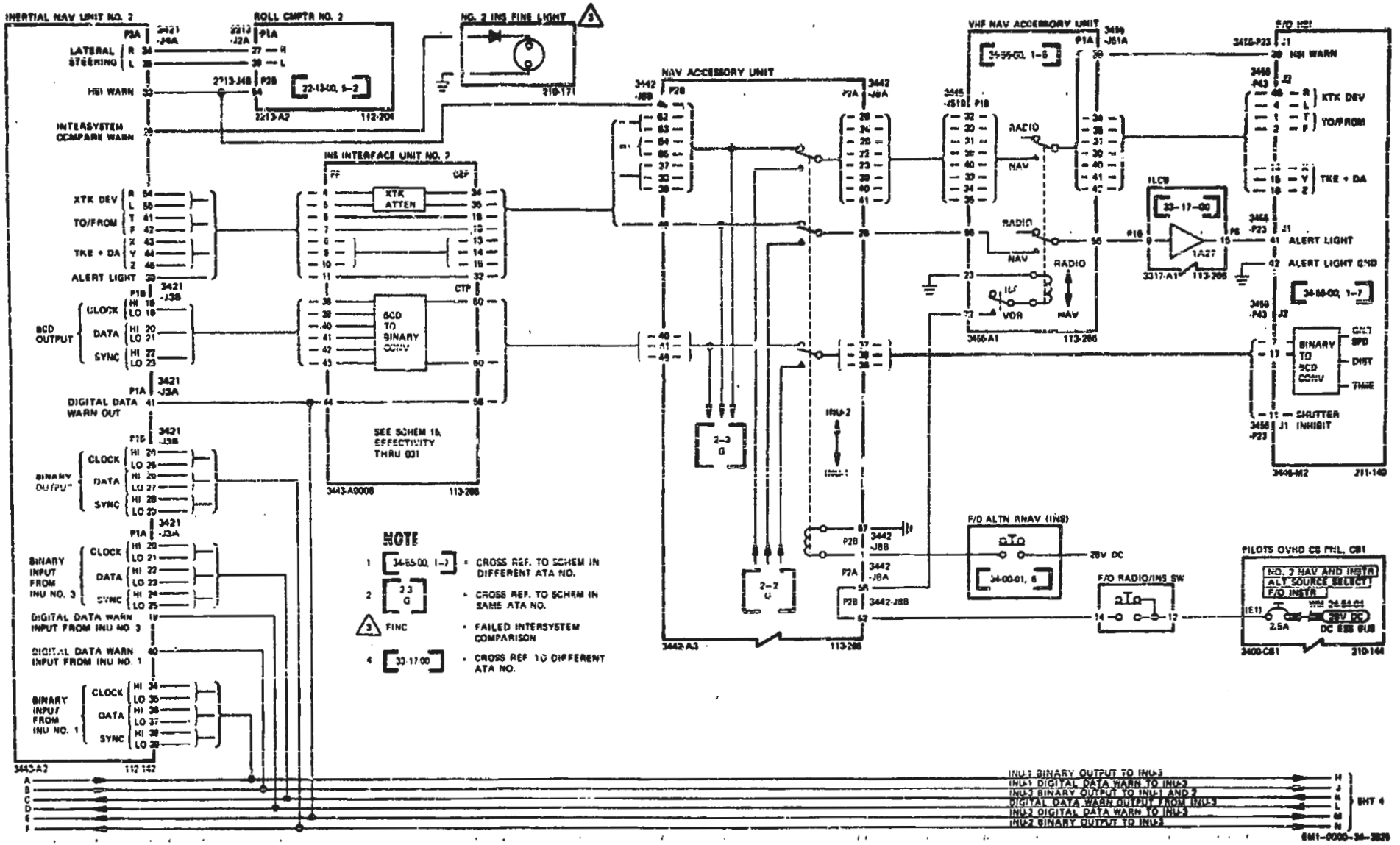


Inertial Navigtion System Schematic (INS Air Data Inputs and CDU/MSU Comm)
SCHEM 2 (Sheet 1)



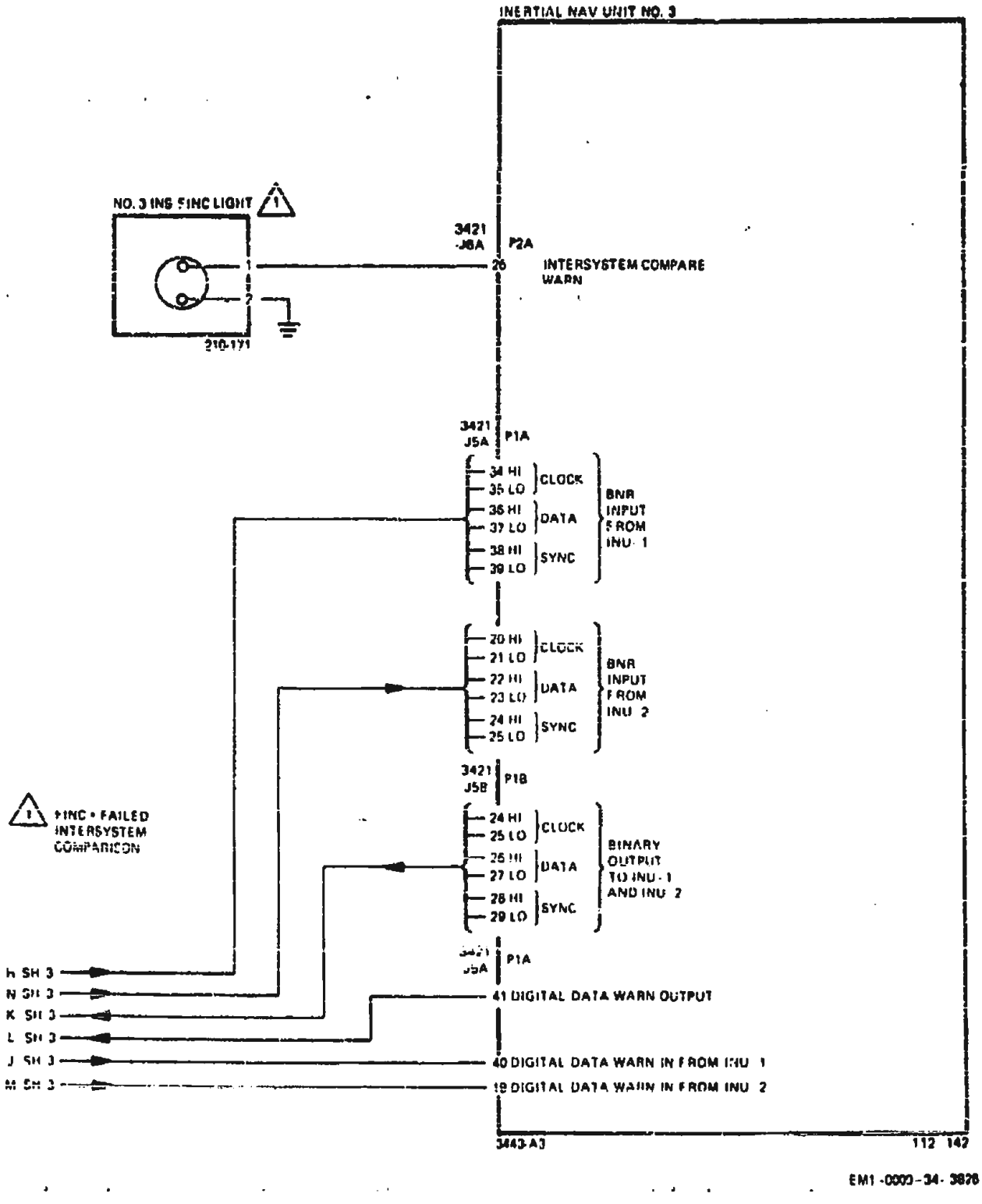
Inertial Navigation System Schematic (INS-1 Output Interface)
SCHEM 2 (Sheet 2)

R EFFECTIVITY: 032-999
R
006B



Inertial Navigation System Schematic (INS-2 Output Interface)
SCHEM 2 (Sheet 3)

R EFFECTIVITY: 032-999
R
006B



Inertial Navigation System Schematic (INS-3 Interface)
SCHEM 2 (Sheet 4)

C INERTIAL NAVIGATION SYSTEM - ADJUSTMENT/TEST

C 1. Operational Test - Inertial Navigation System

C A. General

C (1) The INS operational test is similar to the preflight procedure used to prepare an INS for flight. This requires that exact aircraft present position and intended waypoint latitude and longitude be known. The procedure is identical for each individual INS undergoing test. This test requires no special tools.

C B. Referenced Procedures

C (1) 21-25-00, Equipment Cooling - Adjustment/Test (Operational Test)

C (2) 24-00-00, Electrical Power - Maintenance Practices (Apply Power)

C C. Equipment and Materials

C (1) TWA station latitude/longitude information (Fig. 501, Sheet 2)

C D. Prepare for Test

C (1) Set mode selector switch on each mode selector unit (pilots overhead panel) to OFF position.

C (2) Provide electrical power (Ref. 24-00-00).

C (3) Provide cooling air to INS equipment (Ref. 21-25-00).

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF NAVIGATION UNITS.

C (4) Close all INS, ADI and HSI circuit breakers on
CR electronic circuit breaker panel (CB1) as shown below:

CIRCUIT BREAKERS		
INS-1		
VG/INS-1	(G6)	No.1 Navigation

C		CIRCUIT BREAKERS	
C	INS PWR	(E6)	No. 1 Nav & Instr
C	INS HTR	(E7)	No. 1 Nav & Instr
C	AREA NAV	(E8)	No. 1 Nav & Instr
C	INS-2		
C	INS/VERT GYRO	(G24)	No. 2 Navigation
C	INS HTR	(G25)	No. 2 Navigation
C	AREA NAV	(E26)	No. 2 Nav & Instr
C	ALT ALERT-2	(J21)	NAV EXCIT 26VAC
C	INS-3		
C	INS 3/GYRO 3	(E24)	No.2 Nav & Instr
C	INS 3 HTR	(E25)	No. 2 Nav & Instr
C	ALT ALERT-2	(J21)	NAV EXCIT 26VAC
C	ALT SOURCE SEL -		
CR	CAPTS INSTR	(E1)	No. 1 Nav & Instr
C	F/O INSTR	(E2)	No. 1 Nav & Instr
C	ALTN ADI	(E19)	No. 2 Nav & Instr
C	CAPT ADI	(F2)	No. 1 Instruments
C	F/O ADI	(F20)	No. 2 Instruments
C	CAPT HSI	(F3)	No. 1 Instruments
C	F/O HSI	(F21)	No. 2 Instruments

CIRCUIT BREAKERS

AIR DATA CMPTR	(G8)	No. 1 Navigation
AIR DATA CMPTR	(G27)	No. 2 Navigation

E. Test Inertial Navigation System

(1) Check Turn-On and Lamp Test (All INS).

CAUTION: WHEN CDU WARN LIGHT ILLUMINATES, SELECT DSR TK/STS CHECK ACTION/MALFUNCTION CODES FOR APPROPRIATE MAINTENANCE ACTION. SEE 34-43-00, TROUBLESHOOTING FIGURE 103, SHEET 2 AND 34-43-00, FIGURE 501, SHEET 1.

(a) Place mode selector (pilots' overhead panel) to ALIGN. Check that:

1) Red, amber, and green lamps do not illuminate.

NOTE: Some lights, including the red WARN light and green READY NAV light may flash briefly at turn-on.

2) INSERT key is illuminated.

3) Numerals 0 1 appear in FROM-TO display.

NOTE: If Way-Pt not selected.

4) Place data selector to DSRTK/STS and check that right-hand data display is 0---95.

5) BAT lamp on CDU illuminates for one 10-second period during alignment (mode 8). 0---85. (Mode 8 times intervals approximately 51 seconds)

6) Appropriate ADI should erect.

NOTE: If No. 3 INS is being tested, the captain's ATT ALTN SWITCH (located below captain's HSI) should be depressed to ALTN.

(b) Place data selector to POS and press and hold TEST switch. Check that:

1) All keys (EXCEPT KEYBOARD AND CLEAR keys) and lamps on CDU and MSU illuminate.

2) Numerals 88°88.8 N/S are displayed in left-hand data display.

3) Numerals 888°88.8 E/W are displayed in right-hand data display.

4) Numerals 8 8 are displayed in FROM-TO display.

(c) Press and hold TEST switch while rotating DIM knob and observe that intensity of data displays, FROM-TO display, ALERT lamp, and HOLD, REMOTE, INSERT, and WYPT CHG keys is changed.

(d) Set DIM knob for optimum intensity.

(e) Place data selector to XTK/TKE and observe that decimal point in left-hand display shifts to left.

(f) Place data selector to HDG/DA and observe that degree symbol in both data displays shifts to right.

NOTE: In following procedures where latitude and longitude are displayed, the displayed value may vary slightly (plus or minus 0.1) in the least significant digit from the inserted value. This is a normal condition.

(2) Insert Present Position Data (ALL INS)

NOTE: Present position latitude and longitude should be inserted as soon after turn-on as possible. Automatic alignment of the INS cannot be accomplished until this data is inserted separately into each INS through the individual control display units.

(a) Place data selector to POS and press N2 or S8 key for north or south present position latitude. Check that 00°00.0 followed by correct letter (N or S) appears in left-hand display.

(b) Press numbered keys in sequence for present position latitude and observe that correct latitude appears in left-hand data display.

NOTE: Numbers shift to left in display as each additional number is loaded. If incorrect

C data is displayed, press CLEAR key and
C repeat Steps (a) and (b).

C (c) Press INSERT key and observe that INSERT key light
C remains illuminated.

C (d) Press W4 or E6 key for west or east present
C position longitude and observe that 000°00.0
C followed by correct letter (W or E) appears in
C right-hand data display.

C (e) Press numbered keys in sequence for present
C position longitude and observe that correct
C longitude appears in right-hand data display.

C NOTE: If incorrect data is displayed, press CLEAR
C key and repeat Steps (d) and (e).

C (f) Press INSERT key. Observe that INSERT key light
C extinguishes and that correct present position
C data within 0.1 minute is displayed in both
C left-hand and right-hand displays.

C NOTE: If error is made when inserting present
C position and action/malfunction code 06/58
C occurs, clear by using Steps 1) thru 7)
C below, otherwise skip to Step (g) below:

C 1) Set the MSU switch to STBY.

C 2) Place the CDU data selector switch to POS and
C insert present position Latitude and Longitude.
CR WARN light may come on at the completion of
C insert.

C 3) DELETED

C 4) Rotate CDU data selector switch to DSRTK/STS.
C Code 06 will show.

C 5) Press TEST switch on CDU. WARN light will go
C out and code 06 will clear. Malfunction 58 will
C show.

C 6) Press TEST switch a second time and
C malfunction 58 will clear.

C NOTE: If alignment is stopped or unit shut down
C before alignment is completed the
C malfunction code 58 will be reset and the
C procedure to clear must be performed again
C from the beginning to eliminate the code.

C 7) Set MSU switch to ALIGN.

C (g) Place data selector to WAYPT, waypoint selector to
C 1, and repeat Steps (a) thru (f).

C (3) Insert Waypoint/Destination Data (ALL INS)

C (2) Press REMOTE key on each CDU and observe that
C REMOTE key illuminates on each CDU.

C (b) Place Data Selector to WAYPT and waypoint selector
C to 1.

C NOTE: Remaining steps of this procedure should be
C performed on any one CDU to remotely load
C waypoint data simultaneously into all INS.

C (c) Press N2 or S8 key for north or south first
C waypoint or destination latitude. Observe that
C INSERT key illuminates and that 00°00.0 followed
C by correct letter (N or S) appears in left-hand
C data display.

C (d) Press numbered keys in sequence for first waypoint
C or destination latitude and observe that correct
C latitude appears in left-hand data display.

C NOTE: If incorrect data is displayed, press CLEAR
C key, observe that INSERT key light goes
C out, and repeat Steps (c) and (d).

C (e) Press INSERT key. Observe that INSERT key light
C extinguishes and that correct data (within 0.1
C minute) is still displayed in left-hand data
C display.

C (f) Press W4 or E6 key for west or east waypoint, or
C destination longitude. Observe that INSERT key
C illuminates and that 000°00.0 followed by correct
C letter (W or E) appears in right-hand data
C display.

C (g) Press numbered keys in sequence for first waypoint
C or destination longitude and observe that correct
C longitude (within 0.1 minute) appears in
C right-hand data display.

C NOTE: If incorrect data is displayed, press CLEAR
C key, observe that INSERT key light goes
C out, and repeat Steps (f) and (g).

(h) Press INSERT key. Observe that INSERT key light goes out and correct data is still displayed in right-hand data display.

(i) Repeat Steps (a) through (h) for any additional waypoint/destination insertions and set waypoint selector to positions 3 through 9 consecutively while loading each successive waypoint.

NOTE: If data displays were checked on only one INS during insertion, check displays individually on other CDU's by setting data selector to WAYPT and waypoint selector to each position for which data was inserted. If incorrect data is displayed, reload (remotely) again until data is correct.

(4) Check INS Status (All INS)

(a) Press REMOTE key on each CDU and observe that REMOTE key light goes out in all INS.

(b) Place data selector to DSR TK/STS and observe that three digits appear in right-hand display. (See Fig. 501). The fifth digit from the left represents alignment mode status (9-6) and actual performance index (5). The sixth digit is the desired performance index (5), and always shows 5.

NOTE: The actual performance index number will approach the desired performance index number as INS alignment is refined. When actual alignment status equals desired alignment status, the READY NAV lamp on the mode selector unit will illuminate.

(5) Check INS/HSI Interface

(a) Position the following switches:

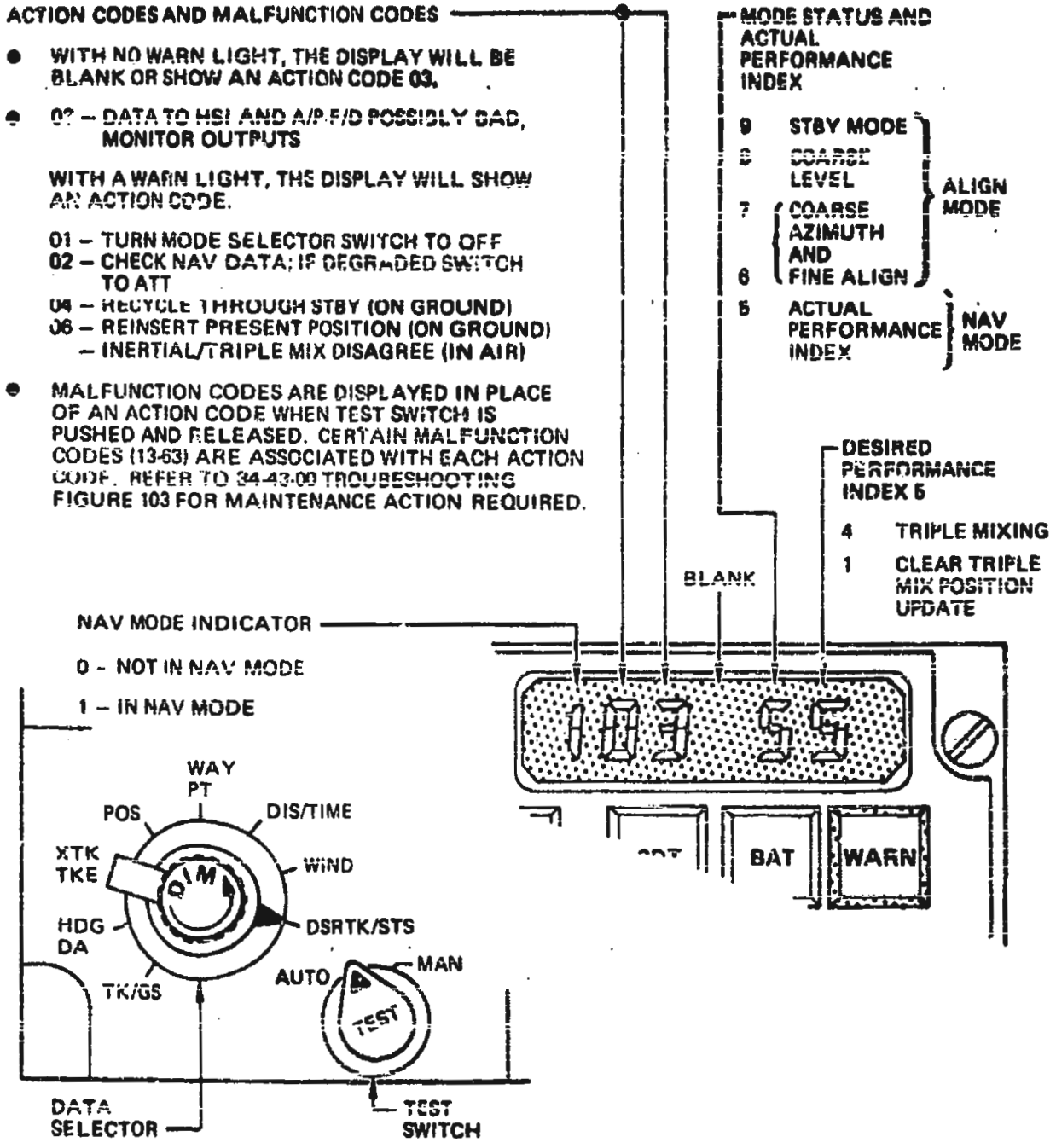
1) RNAV ALTN switch to normal (extinguished) position (Capt 1 - F/O 2)

2) RADIO/INS switch to INS (forward pedestal)

3) Data selector switch to WIND (pilots control stand)

4) INS Mode Selector to ALIGN

NOTE: Alignment mode status must be 8 or less prior to this step.


ACTION CODES AND MALFUNCTION CODES
WITH NO WARN LIGHT, THE DISPLAY WILL BE BLANK OR SHOW AN ACTION CODE 03.
02 – DATA TO HSI AND A/P F/D POSSIBLY BAD, MONITOR OUTPUTS
WITH A WARN LIGHT, THE DISPLAY WILL SHOW AN ACTION CODE.
01 – TURN MODE SELECTOR SWITCH TO OFF
02 – CHECK NAV DATA; IF DEGRADED SWITCH TO ATT
04 – RECYCLE THROUGH STBY (ON GROUND)
06 – REINSERT PRESENT POSITION (ON GROUND)
– INERTIAL/TRIPLE MIX DISAGREE (IN AIR)
MALFUNCTION CODES ARE DISPLAYED IN PLACE OF AN ACTION CODE WHEN TEST SWITCH IS PUSHED AND RELEASED. CERTAIN MALFUNCTION CODES (13-63) ARE ASSOCIATED WITH EACH ACTION CODE. REFER TO 34-43-00 TROUBESHOOTING FIGURE 103 FOR MAINTENANCE ACTION REQUIRED.
MODE STATUS AND ACTUAL PERFORMANCE INDEX
9 STBY MODE
8 COARSE LEVEL
7 COARSE AZIMUTH AND
6 FINE ALIGN
ALIGN MODE
5 ACTUAL PERFORMANCE INDEX
NAV MODE
DESIRED PERFORMANCE INDEX 5
4 TRIPLE MIXING
1 CLEAR TRIPLE MIX POSITION UPDATE
BLANK
NAV MODE INDICATOR
0 - NOT IN NAV MODE
1 – IN NAV MODE
WAY PT
POS
DIS/TIME
XTK TKE
WIND
DIM
HDG DA
DSRTK/STS
TK/GS
AUTO
MAN
TEST
BAT
WARN
DATA SELECTOR
TEST SWITCH

M1-0003-34-3488

CR
CR

INS Status/Malfunction Code Display
Figure 501 (Sheet 1)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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GEOGRAPHIC GATE POSITIONS - DOMESTIC

AIRPORT	GATES	LATITUDE	LONGITUDE	ICAO IDENT	IATA IDENT
ALBUQUERQUE		N35°02.5'	W106°36.4'	KABQ	ABQ
AMARILLO		N35°13.1'	W101°42.2'	KAMA	AMA
ATLANTA		N33°39.1'	W 84°25.6'	KATL	ATL
ATLANTIC CITY		N39°26.9'	W 74°35.0'	KACY	ACY
AUSTIN		N30°17.6'	W 97°42.0'	KAUS	AUS
BALTIMORE	3,5	N39°10.8'	W 76°40.0'	KBWI	BWI
BANGOR		N44°48.0'	W 68°49.0'	KBGR	BGR
BOISE		N43°34.1'	W116°13.2'	KBOI	BOI
BOSTON	HGR	N42°22.4'	W 71°01.3'	KBOS	BOS
BOSTON	TWA	N42°22.1'	W 71°00.9'	KBOS	BOS
BOSTON	IAB	N42°22.2'	W 71°01.2'	KBOS	BOS
BUFFALO		N42°56.2'	W 78°43.9'	KBUF	BUF
CHICAGO	HGR	N41°59.3'	W 87°55.1'	KORD	ORD
CHICAGO	TWA	N41°58.4'	W 87°54.2'	KORD	ORD
CINCINNATI		N39°03.2'	W 84°39.6'	KCVG	CVG
CLEVELAND		N41°24.7'	W 81°50.5'	KCLE	CLE
COLORADO SPRINGS		N38°46.0'	W104°42.3'	KCOS	COS
COLUMBUS		N39°59.8'	W 82°53.0'	KCMH	CMH
DALLAS-FT. WORTH		N32°53.8'	W 97°02.0'	KDFW	DFW
DAYTON		N39°54.1'	W 84°13.2'	KDAY	DAY
DENVER	TWA	N39°45.8'	W104°53.3'	KDEN	DEN
DES MOINES		N41°32.0'	W 93°39.0'	KDSM	DSM
DETROIT	TWA	N42°13.3'	W 83°20.9'	KDTW	DTW
EVERETT		N47°54.5'	W122°16.9'	KPAE	PAE
FT. LAUDERDALE		N26°04.3'	W 80°08.8'	KFLL	FLL
HOUSTON -					
HOBBY		N29°38.6'	W 95°17.2'	KHOU	HOU
INTERCONTINENTAL		N29°59.2'	W 95°20.9'	KIAH	IAH
INDIANAPOLIS	TWA	N39°43.3'	W 86°16.5'	KIND	IND
JACKSONVILLE		N30°29.6'	W 81°41.2'	KJAX	JAX
KANSAS CITY	HGR	N39°17.7'	W 94°41.8'	KMCI	MCI
KANSAS CITY	TWA	N39°17.7'	W 94°43.3'	KMCI	MCI
LAS VEGAS	TWA	N36°05.1'	W115°09.1'	KLAS	LAS
LOS ANGELES	TWA	N33°56.8'	W118°24.4'	KLAX	LAX
LOUISVILLE		N38°11.1'	W 85°44.5'	KSDF	SDF
MIAMI		N25°47.7'	W 80°16.8'	KMIA	MIA
MILWAUKEE		N42°56.9'	W 87°54.0'	KMKE	MKE
MINNEAPOLIS		N44°53.0'	W 93°12.9'	KMSP	MSP
MONTREAL		N45°27.3'	W 73°45.1'	CYUL	YUL
MONTREAL - MIRABEL		N45°40.8'	W 74°01.4'	CYMX	YMX

GEOGRAPHIC GATE POSITIONS - DOMESTIC (CONT'D)

AIRPORT	GATES	LATITUDE	LONGITUDE	ICAO IDENT	IATA IDENT
NEWARK	TWA	N40°41.2'	W 74°10.8'	KEWR	EWR
NEW ORLEANS		N29°59.1'	W 90°16.0'	KMSY	MSY
NEW YORK -					
KENNEDY	FW 1	N40°38.8'	W 73°46.6'	KJFK	JFK
KENNEDY	FW 2	N40°38.7'	W 73°46.6'	KJFK	JFK
KENNEDY	DOM	N40°38.9'	W 73°46.7'	KJFK	JFK
KENNEDY	HGR 12	N40°38.9'	W 73°48.4'	KJFK	JFK
LA GUARDIA	TWA	N40°46.6'	W 73°52.3'	KLGA	LGA
NEWBURGH		N41°30.3'	W 74°06.0'	KSWF	SWF
OAKLAND		N37°43.9'	W122°12.8'	KOAK	OAK
OKLAHOMA CITY		N35°23.7'	W 97°35.8'	KOKC	OKC
ONTARIO		N34°03.6'	W117°37.1'	KONT	ONT
ORLANDO		N28°25.9'	W 81°18.9'	KMCO	MCO
OTTAWA		N45°19.4'	W 75°40.4'	CYOW	YOW
PALMDALE		N34°38.0'	W118°06.0'	KPMD	PMD
PALM SPRINGS		N33°49.5'	W116°30.5'	KPSP	PSP
PHILADELPHIA	TWA	N39°52.5'	W 75°14.6'	KPHL	PHL
PHOENIX	TWA	N33°26.1'	W112°00.8'	KPHX	PHX
PITTSBURGH	TWA	N40°29.8'	W 80°13.0'	KPIT	PIT
RENO		N39°30.4'	W119°46.4'	KRNO	RNO
ROCKFORD		N42°12.0'	W 89°05.7'	KRFD	RFD
SACRAMENTO		N38°41.6'	W121°35.7'	KSMF	SMF
ST. LOUIS		N38°44.6'	W 90°21.9'	KSTL	STL
SALT LAKE CITY		N40°47.2'	W111°58.6'	KSLC	SLC
SAN ANTONIO		N29°31.8'	W 98°28.4'	KSAT	SAT
SAN DIEGO		N32°44.0'	W117°11.9'	KSAN	SAN
SAN FRANCISCO	TWA	N37°36.8'	W122°23.0'	KSFO	SFO
SAN JOSE		N37°21.7'	W121°55.3'	KSJC	SJC
SEATTLE - BOEING FIELD		N47°31.9'	W122°18.1'	KBFI	BFI
SEATTLE - TACOMA		N47°26.5'	W122°18.2'	KSEA	SEA
SPOKANE		N47°37.5'	W117°32.1'	KGEG	GEG
SYRACUSE		N43°06.8'	W 76°06.6'	KSYR	SYR
TAMPA		N27°58.9'	W 82°32.1'	KTPA	TPA
TOPEKA		N38°57.1'	W 95°40.6'	KFOE	FOE
TORONTO		N43°41.0'	W 79°37.3'	CYYZ	YYZ
TUCSON		N32°07.2'	W110°56.3'	KTUS	TUS
TULSA	TWA	N36°11.5'	W 95°53.3'	KTUL	TUL
VANCOUVER		N49°11.7'	W123°11.0'	CYVR	YVR
WASHINGTON		N38°56.7'	W 77°26.7'	KIAD	IAD
WICHITA		N37°39.1'	W 97°25.7'	KICT	ICT
WINDSOR LOCKS	TWA	N41°56.1'	W 72°41.1'	KBDL	BDL
WINNIPEG		N49°54.2'	W 97°13.9'	CYWG	YWG

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CR Station Latitude and Longitude
CR Figure 501 (Sheet 3)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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GEOGRAPHIC GATE POSITIONS - INTERNATIONAL

AIRPORT	GATES	LATITUDE	LONGITUDE	ICAO IDENT	IATA IDENT
ANKARA		N40°07.6'	E 33°00.0'	LTAC	ESB
ATHENS	NEW	N37°53.2'	E 23°44.3'	LGAT	ATH
BARCELONA		N41°18.3'	E 2°05.0'	LEBL	BCN
BORDEAUX		N44°49.8'	W 0°42.4'	LFBD	BOD
BRUSSELS		N50°53.9'	E 4°26.2'	EBBR	BRU
CAIRO	TWA	N30°07.8'	E 31°24.3'	HECA	CAI
COLOGNE - BONN		N50°52.7'	E 7°07.3'	EDDK	CGN
DUBLIN		N53°25.7'	W 6°14.8'	EIDW	DUB
EDMONTON		N53°18.5'	W113°35.1'	CYEG	YEG
FARO		N37°01.0'	W 7°58.2'	LPFR	FAO
FRANKFURT	TWA	N50°02.9'	E 8°35.1'	EDDF	FRA
GANDER		N48°56.8'	W 54°34.5'	CYQX	YQX
GENEVA		N46°14.0'	E 6°06.4'	LSGG	GVA
GENOA		N44°24.9'	E 8°50.8'	LIMJ	GOA
GLASGOW		N55°52.0'	W 4°25.8'	EGPF	GLA
GOOSE BAY		N53°19.3'	W 60°24.8'	CYYR	YYR
HALIFAX		N44°53.2'	W 63°30.9'	CYHZ	YHZ
IRAKLION		N35°20.1'	E 25°10.1'	LIGR	HER
ISTANBUL		N40°58.6'	E 28°49.2'	LTBA	IST
KEFLAVIK	5	N63°58.6'	W 22°35.5'	BIKF	KEF
LAJES		N38°46.2'	W 27°05.8'	LPLA	LGS
LARNACA		N34°52.0'	E 33°37.7'	LCLK	LCA
LILLE		N50°34.1'	E 3°05.8'	LFQQ	LIL
LISBON	TWA	N38°46.2'	W 9°07.8'	LPPT	LIS
LONDON					
HEATHROW	TWA	N51°28.2'	W 0°27.6'	EGLL	LHR
GATWICK		N51°09.3'	W 0°10.0'	EGKK	LGW
STANSTED		N51°53.0'	E 0°14.0'	EGSS	STN
LUXEMBOURG		N49°38.0'	E 6°13.0'	ELLX	LUX
LUXOR		N25°40.2'	E 32°41.7'	HELX	LXR
MADRID	TWA	N40°28.1'	W 3°34.0'	LEMD	MAD
MALAGA		N36°40.4'	W 4°29.4'	LEMG	AGP
MANCHESTER		N53°21.5'	W 2°16.3'	EGCC	MAN
MARSEILLE		N43°26.5'	E 5°13.3'	LFML	MRS
MILAN	TWA	N45°38.8'	E 8°43.5'	LIMC	MXP
NICE		N43°39.8'	E 7°12.8'	LFMN	NCE
PALMA		N39°33.0'	E 2°43.7'	LEPA	PMI
PARIS					
CHARLES DE GAULLE		N49°00.9'	E 2°32.7'	LFPO	CDG
ORLY		N48°43.6'	E 2°21.8'	LFPO	ORY
PISA		N43°41.7'	E 10°23.8'	LIRP	PSA
PRESTWICK		N55°30.6'	W 4°36.5'	EGPK	PIK
PORTO		N41°14.1'	W 8°40.5'	LPPR	PRT
RAMAT DAVID		N32°40.0'	E 35°10.1'	LLRD	- -
RHODOS		N36°24.3'	E 12°06.5'	LGRP	RHO
ROME					
FLUMICINO	TWA	N41°47.7'	E 12°14.8'	LIRF	FCO
CIAPINO		N41°48.0'	E 12°36.0'	LIRA	CIA
SANTA MARIA	TWA	N36°58.4'	W 25°10.1'	LPAZ	SMA
SANTIAGO		N42°53.7'	W 8°25.2'	LEST	SCQ
SHANNON	TWA	N52°41.6'	W 8°55.2'	EINN	SNN
STUTTGART		N48°41.4'	E 9°12.0'	EDDS	STR
TEL AVIV	TWA	N31°59.8'	E 34°53.5'	LLBG	TLV
THESSALONIKI		N40°31.5'	E 22°58.5'	LGTS	SKG
TORINO		N45°11.6'	E 7°38.8'	LIMF	TRN
VENICE		N45°30.0'	E 12°20.5'	LIPZ	VCE
ZURICH		N47°27.2'	E 8°33.6'	LSZH	ZRH

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CR
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Station Latitude and Longitude
Figure 501 (Sheet 4)

EFFECTIVITY: INS EQUIPPED AIRCRAFT

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C (b) Press and hold TEST switch on control/display
C unit. Observe the following indications on
C appropriate HSI.

C 1) HDG flag and NAV annunciator are out of view.

C 2) Course pointer and 0 on azimuth card are
C positioned under lubber line. Course window shows
C 000.

C 3) Course deviation bar is positioned one dot to
C right of center.

C 4) ALERT light illuminates.

C 5) Digital data DISTANCE, GND SPD, and TIME show
C 8's.

C 6) ALERT annunciator illuminates.

C 7) To-From pointer indicates TO.

C (c) Release test switch.

C (6) Check ready nav status.

C (a) Place data selector to DSRTK/STS position.

C (b) Place mode selector to NAV. Observe that READY
C NAV light stays on, that flight instrument warning
C flags controlled by INS disappear and that
C left-most digit of the right display changes from
C 0 to 1 when INS alignment status reaches desired
CR alignment status. Check that CDU WARN light is
CR extinguished.

C F. Restore Airplane to Normal

C (1) Place mode selector in OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE
C INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND
C DEPLETE BATTERY. INS OVERHEAT DAMAGE WILL REQUIRE
C INS NAVIGATION UNIT REPLACEMENT.

C (2) Remove electrical power if no longer required. Refer
C to 24-00-00.

C (3) Remove equipment cooling if no longer required. Refer
C to 21-25-00.

C 2. System Test - Inertial Navigation System

C A. General

CR CAUTION: WHEN CDU WARN LIGHT ILLUMINATES, SELECT DSR TK/STS
CR AND CHECK ACTION/MALFUNCTION CODES FOR APPROPRIATE
CR MAINTENANCE ACTION. SEE FIGURE 501 AND
CR TROUBLESHOOTING SECTION, FIGURE 103.

C (1) The following procedure accomplishes a system test of
C the inertial navigation system (INS) and interfacing
C components. The system test provides a complete system
C checkout of the inertial navigation system and will
C normally be performed only at overhaul maintenance
C periods or when sufficient maintenance is accomplished
C as to leave the integrity of the total system in doubt.

C (2) The INS system test requires two men, one in the
C forward equipment service center and one on the flight
C deck.

C (3) The test procedure allows the testing of the entire
C inertial navigation system including interface tests or
C it allows the performance of individual tests
C including:

C (a) Battery Unit Tests [Paragraph 2.E.(1)].

C (b) Navigation Unit, Control/Display Unit and INS
C Intersystem Comparison Warning Tests [Paragraph
C 2.E.(2)].

C (c) INS/Central Air Data System Interface Tests
C [Paragraph 2.E.(3)].

C (d) INS/HSI Interface Tests [Paragraph 2.E.(4)].

C (e) INS/ADI Interface Tests [Paragraph 2.E.(5)].

C (f) INS/AFCS Interface Tests [Paragraph 2.E.(6)].

C (4) For interfacing systems not mentioned above, refer to
C the Maintenance Practices sections covering those
C systems.

C (5) The system installation, inspection and wiring
C continuity tests shall have been completed, prior to
C performing these tests.

C (6) Correct functioning of the electrical distribution
C system shall be determined prior to this test.

C (7) Proper completion of this test specification requires
C accurate knowledge of airplane test location position
C expressed in degrees and arc-minutes accurate to .1
C arc-minute of latitude. (Ref. Fig. 501, Sheet 2).

C (8) Proper completion of this test also requires that the
C following systems or components be operational during
C the test.

C (a) Central Air Data System (CADS)

C (b) Attitude Director Indicators (ADI)

C (c) Horizontal Situation Indicators (HSI)

C (d) Auto Flight System (AFCS)

C (9) Correct functioning of the equipment cooling system
C shall be determined prior to this test.

C (10) The Prepare For Test procedure must be completed before
C the system test can be accomplished. However, the
C Prepare For Test procedure does not need to be repeated
C for each test if two or more tests are to be performed
C in sequence.

C (11) At the completion of the test(s), restore airplane to
C normal. (Refer to Para. 2F.)

C B. Equipment and Materials

C (1) Figure 501 (Sheet 2) containing TWA station
C latitude/longitude.

C (2) Gimbal Slew Test Enable Connector Assemblies - Delco
CR Electronics, Part No. 7888466 (3 required).

C NOTE: These gimbal slew test connectors are only
C required for the INS/ADI interface test.

C C. Referenced Procedures

C (1) 21-25-00, Equipment Cooling - Adjustment/Test
C (Operating Test)

C (2) 22-00-00, Auto Flight - Adjustment/Test (General Test)

C (3) 24-00-00, Electrical Power - Maintenance Practices
C (Apply Power)

C (4) 33-00-00, Pilots Panel Lights - Adjustment/Test

C (5) 34-43-03, INS Navigation Unit - Adjustment/Test
C (Battery Charger Test)

C (6) 34-43-05, INS Battery Unit - Inspection/Check

C D. Prepare for Test

C (1) Set mode selector switch on each mode selector unit
C (pilots overhead panel) to OFF position.

C (2) Set both CAPT's and F/O's RADIO/INS switches to INS.

C (3) Check that ATT ALTN switches on the captain's and first
C officer's main instrument panel to NORM (released)
C position.

C (4) Provide electrical power. Refer to 24-00-00.

C (5) Check for proper operation of pilots panel
C illumination, indicator lamps and annunciator lights
C using master test and dim control. Refer to 33-00-00.

C (6) Ensure inertial navigation systems No. 1, 2 and 3 have
C battery, control/display and mode selector units
C properly installed.

C (7) Provide cooling air to INS equipment. Refer to
C 21-25-00.

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION
C UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE
C ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF
C NAVIGATION UNITS.

C (8) Check for proper FESC equipment cooling fan operation:

C (a) On the galley right circuit breaker panel, zone
C 131, verify circuit breaker FWD AVIONICS FAN is
C closed.

C (b) On the Flight Engineer/Second Officers aft circuit
C breaker panel CB3, zone 215, verify INS COOLING
C FAN - CONT (C19) and FAN (C21) circuit breakers
C are closed.

C (c) On the Flight Engineer/Second Officers ECS MONITOR
C panel, zone 125, release INS COOLING switchlight
C to the normal (out) position.

C (d) Verify FESC exhaust fan is operating and exhaust
C control valve is open. To verify, check for
C fan-driven exhaust air flow from the approximately

C 6 by 8 inch oval opening in the lower right
C forward fuselage, below the flight station
C windows.

C (e) On Flight Engineer/Second Officers ECS MONITOR
C panel, zone 215, verify the following:

C 1) AVIONIC AIR - FWD indicator light: OVBD legend
C on, LO FLO legend off.

C 2) INS COOLING switchlight: ON legend off, LO FLO
C legend off.

C CAUTION: WHEN AVIONIC AIR-FWD INDICATOR LO FLO IS
C ILLUMINATED, THE INS MAY NOT HAVE SUFFICIENT
C COOLING AIR. IN SUCH AN EVENT, THE INS COOLING ON
C LEGEND SHOULD BE ILLUMINATED. DO NOT OPERATE INS
C WHEN AVIONIC AIR-FWD INDICATOR LO-FLO IS
C ILLUMINATED TO PREVENT INS NAVIGATION UNIT DAMAGE.

C (9) On the pilot's overhead circuit breaker panel CB1,
C verify that the listed circuit breakers are closed:

INS-1		
VG/INS-1	(G6)	No. 1 Navigation
INS PWR	(E6)	No. 1 Nav & Instr
INS HTR	(E7)	No. 1 Nav & Instr
AREA NAV	(E8)	No. 1 Nav & Instr
INS-2		
INS/VERT GYRO	(G24)	No. 2 Navigation
INS HTR	(G25)	No. 2 Navigation
AREA NAV	(E26)	No. 2 Nav & Instr
ALT ALERT-2	(J21)	NAV EXCIT 26 VAC
INS-3		
INS 3/GYRO 3	(E24)	No. 2 Nav & Instr
INS 3 HTR	(E25)	No. 2 Nav & Instr
ALT ALERT-2	(J21)	NAV EXCIT 26VAC
INTERFACING SYSTEMS		
ALT SOURCE SEL -		No. 1 Nav & Instr
CAPTS INSTR	(E1)	No. 1 Nav & Instr
F/O INSTR	(E2)	

C

C **INS-1**

C

ALTN ADI	(E19)	No. 2 Nav & Instr
CAPT ADI	(F2)	No. 1 Instruments
F/O ADI	F20)	No. 2 Instruments
CAPT HSI	(F3)	No. 1 Instruments
F/O HSI	(F21)	No. 2 Instruments
AIR DATA CMPTR	(G8)	No. 1 Navigation
AIR DATA CMPTR	(G27)	No. 2 Navigation
PITCH & ROLL	(A6)	Avionics Flight Control System
PITCH & ROLL	(A24)	Avionics Flight Control System

C

(10) In the forward electronic service center (FESC), verify that circuit breakers on the INS batteries INS Bat-1, INS Bat-2 and INS Bat-3, forward left rack, are closed (pushed in).

E. Test Inertial Navigation System

(1) Test Battery Units

(a) Prepare for test as described in Paragraph 2D.

(b) Examine each battery unit for internal damage and electrolyte level (Ref. 34-43-05, INS Battery Unit - Inspection/Check).

(c) Test battery unit/navigation unit interface.

1) Open circuit breaker on front panel of each INS battery unit.

2) Set mode selector switch on each MSU (mode selector unit on pilots overhead panel) to STBY position.

3) Depress TEST switch on each control/display unit and verify that system is not on by observing that annunciators and digital displays do not illuminate.

4) Set mode selector switch on each MSU to OFF position.

5) Close circuit breaker on front panel of each INS battery unit.

C 6) Set mode selector switch on each MSU to STBY
C position. Check that on each control/display unit
C (CDU) and mode selector unit (MSU):

C a) Red, amber and green lamps do not
C illuminate.

C NOTE: Some lights, including the red WARN light
C and green READY NAV light, may flash
C briefly at turn on.

C b) CDU INSERT key is illuminated.

C c) CDU FROM-TO display shows 0 1.

C 7) Set data selector on each control/display unit
C to DSRTK/STS position and check that right-hand
C data displays are 0--95.

C 8) Momentarily press each CDU TEST switch. While
C switches are depressed, check that:

C a) HOLD, REMOTE, INSERT and WY PT CHG keys
C plus ALERT, BAT and WARN annunciators
C illuminate on each CDU.

C b) BAT and READY NAV annunciators on each MSU
C illuminate.

C c) All three data display indicators on each
C CDU are showing all eights.

C (d) Test INS navigation unit battery charger

C 1) Perform INS battery charger test on each of
C the inertial navigation systems. Refer to
C 34-43-04, INS Navigation Unit-Adjustment/Test
C (Battery Charger Test).

C (e) If INS is no longer required, restore airplane to
C normal.

C (2) Test Navigation Unit, Control Display Unit and INS
C Intersystem Comparison Monitor Light Interface.

C (a) If required, prepare for test as described in
C Paragraph 2 D.

C (b) Set mode selector switch on each MSU (mode
C selector unit on pilots' overhead panel) to STBY
C position.

C (c) Place each INS in LOOK routine by performing
C following on each control/display unit.

C 1) Set data selector to POS.

C 2) Press WY PT CHG key.

C 3) Enter 99 on data keys so FROM-TO displays 9 9.

C 4) Do not insert but press the CLEAR key.
C Observe that the WY PT CHG light turns off and 99
C remains in the FROM-TO display.

C 5) Ensure that waypoint select thumbwheel is set
C at 0.

C (d) Check contents of memory location 2776 for each
C control display unit.

C 1) Set data selector to WAY PT.

C 2) Enter N2776 on data keys. (INS Program
C Identification)

C 3) Press INSERT key. Check that 2776 appears in
C both displays.

C 4) Set data selector to DIS/TIME. Data display
C indicators now read contents of memory location
C 2776.

CR 5) Check that contents of memory location 2776 is
CR 4663-0015 or 4663-0020 for each CDU.

C (e) Check contents of memory location 30 for each
C control/display unit.

C 1) Set data selector to WAY PT.

C 2) Enter N30 on data keys. (Memory location for
C Autopilot Steering program pins).

C 3) Press INSERT key. Check that 0030 appears in
C both data displays.

C 4) Set data selector to DIS/TIME. Check that
C contents of memory location 30 are XXOX XXXX where
C X is any number.

C (f) Check contents of memory location 26 for each
C control/display unit.

C 1) Set data selector to WAY PT.

C 2) Enter N26 on data keys. (memory location for
C HSI true heading aft mounting and TAS analog
C program pins).

C 3) Press INSERT key. Check that 0026 appears in
C both data displays.

C 4) Set data selector to DIS/TIME. Check that
C contents of memory location 26 are 52XX XXXX where
C X is any number.

C (g) Return each INS to normal by performing following
C on each control/display unit.

C 1) Set data selector to POS.

C 2) Press WY PT CHG key.

C 3) Enter 01 on data keys so FROM-TO displays 0 1.

C 4) Press INSERT key.

C (h) On each control/display and mode selector unit,
C check that there are no red, amber or green lamps
C illuminated.

C (i) Perform following sequence on each control/display
C unit.

C 1) Place data selector to POS and press and hold
C TEST switch. Check that:

C a) All keys (except keyboard and CLEAR keys)
C and lamps on CDU and MSU illuminate.

C b) Numerals 88°88.8 N/S are displayed in
C left-hand data display.

C c) Numerals 888°88.8 E/W are displayed in
C right-hand data display.

C d) Numerals 8 8 are displayed in FROM-TO
C display.

C 2) Press and hold TEST switch while rotating DIM
C knob and observe that intensity of data displays,
C FROM-TO display, ALERT lamp, and HOLD, REMOTE,
C INSERT, and WY PT CHG keys is changed. Check that
C respective COMPARATOR light illuminates
C (brilliance not adjustable).

3) Set DIM knob for optimum intensity.

4) Place data selector to XTK/TKE and observe that:

a) Left-hand data display shifts to 888.88°N/S.

b) Right-hand data display shifts to 888888° E/W.

5) Place data selector to HDG/DA and observe that:

a) Left-hand data display shifts to 8888.8° N/S.

b) Right-hand data display remains 888888° E/W.

6) Release TEST switch.

(j) Set data selector on each control/display unit to DSRTK/STS position. Check that each right-hand data display is 0--95.

(k) Set mode selector switch on each mode selector unit to ALIGN position. Check that each CDU right-hand data display is 0--85.

(l) Check that BAT lamp on each CDU illuminates for one 10-second period during coarse alignment (mode status 8). (See Fig. 501).

(m) Check that each INS continues to align through mode status 7 (course azimuth). After approximately 4 minutes, verify that alignment does not proceed to mode 6 automatically.

NOTE: In following procedures where latitude and longitude are displayed, the displayed value may vary slightly (plus or minus 0.1) in the least significant digit from the inserted value. This is a normal condition.

(n) Insert correct present position data in each INS.

NOTE: Automatic alignment of INS cannot be completed until this data is inserted separately into each INS through the individual control display units.

C 1) Place data selector to POS and press N2 or S6 key for north or south present position latitude. Check that 00°00.0 followed by correct letter (N or S) appears in left-hand data display.

C 2) Press numbered keys in sequence for present position latitude and observe that correct latitude appears in left-hand data display.

C NOTE: Numbers shift to left in display as each additional number is loaded. If incorrect data is displayed, press CLEAR key and repeat Steps 1) and 2).

C 3) Press INSERT key and observe that INSERT key light remains illuminated.

C 4) Press W4 or E6 key for west or east present position longitude and observe that 000°00.0 followed by correct letter (W or E) appears in right-hand data display.

C 5) Press numbered keys in sequence for present position longitude and observe that correct longitude appears in right-hand data display.

C NOTE: If incorrect data is displayed, press CLEAR key and repeat Steps 4) and 5).

C 6) Press INSERT key. Observe that INSERT key light extinguishes and that correct present position data within ± 0.1 arc-minute is displayed in both left-hand and right-hand displays. If INSERT light does not go out, repeat Steps 1) through 6).

C (o) Position data selector to DSRTK/STS and check that each INS continues to align through mode status 6 (fine align). (See Fig. 501.)

C (p) Observe each control/display unit and check that when actual performance index equals desired performance index (Fig. 501) the READY NAV light on associated mode selector unit illuminates.

C (q) Insert waypoint/destination data.

C 1) Press REMOTE key on each control/display unit and observe that REMOTE keys illuminate.

C 2) Place data selectors to WAY PT and waypoint selectors to 1.

C C 3) On any one control/display unit, perform following:

C C C C C a) Press N2 or S8 key for north or south first waypoint latitude. Observe that INSERT key illuminates and that 00°00.0 followed by correct letter (N or S) appears in left-hand data display.

C C C C b) Press numbered keys in sequence for first waypoint latitude and observe that correct latitude appears in left-hand data display.

C C C NOTE: If incorrect data is displayed, press CLEAR key, observe that INSERT key light goes out, and repeat Steps a) and b).

C C C C c) Press INSERT key. Observe that INSERT key light extinguishes and that correct data (within 0.1 arc-minute) is still displayed in left-hand data display.

C C C C C d) Press W4 or E6 key for west or each waypoint longitude. Observe that INSERT key illuminates and that 000°00.0 followed by correct letter (W or E) appears in right-hand data display.

C C C C C e) Press numbered keys in sequence for first waypoint longitude and observe that correct longitude (within 0.1 arc-minute) appears in right-hand data display.

C C C NOTE: If incorrect data is displayed, press CLEAR key, observe that INSERT key goes out, and repeat Steps d) and e).

C C C C f) Press INSERT key. Observe that INSERT key light goes out and that correct data is still displayed in right-hand data display.

C C C C 4) Check right-and left-hand data displays on other CDU's for an identical display (within tolerance) of data from Step 3).

C C C C C 5) Repeat Steps 2) through 4) for additional waypoint insertions using a different CDU to do data loading each time. Set waypoint selector to positions2 and 3 consecutively while loading each successive waypoint.

C NOTE: Repeat waypoint loading until each CDU has
C been used for remote loading into other
C INS's. If incorrect data is displayed,
C check for cause of trouble and attempt
C remote loading again.

C 6) Press REMOTE key on each CDU and observe that
C each REMOTE key light goes out.

C 7) Place waypoint selectors to 3 thru 9 and check
C each waypoint display for "N" and "E" and all
C zeros.

C (r) Intersystem Comparison Warning Verification

C 1) Set data selector on INS No. 1 CDU to TK/GS
C position.

C 2) Press and hold INS No. 1 CDU TEST button.

C 3) Verify (on forward pedestal panel) that INS 1
CR intersystem comparison monitor light illuminates
CR amber.

C 4) Release TEST button.

C 5) Repeat Steps 1) through 4) for INS No. 2 and
C INS No. 3.

C (s) If INS is no longer required, restore airplane to
C normal per Paragraph F.

C (4) Test Inertial Navigation System/Central Air Data System
C Interface

C (a) If required, prepare for test as described in
C Paragraph 2 D.

C (b) Set mode selector switch on each MSU (mode
C selector unit on pilots' overhead panel) to STBY
C position.

C (c) Place each INS in LOOK routine by performing
C following on each control/display unit.

C 1) Set data selector to POS.

C 2) Press WY PT CHG key.

C 3) Enter 99 on data keys so FROM-TO displays 9 9.

C 4) Press INSERT key.

C 5) Set data selector to WAY PT.

C 6) Enter N26 on data keys.

C 7) Set waypoint select thumbwheel to 0.

C 8) Press INSERT key. Check that 0026 appears in
C both data displays.

C 9) Set data selector to DIS/TIME. Data display
C indicators now read contents of memory location
C 26. (TAS flag from the CADC)

C 10) Observe the Y contents of right display YXXX
C (X any number).

C (d) Press and hold No. 1 central air data computer
C self-test pushbutton. Observe that CDU for INS
C No. 1 contents of right display XXXX increase by
C 4 counts compared to previous contents while
C Captains altimeter flag is in view. Keep
C self-test pushbutton depressed.

C (e) Perform following on control/display units for INS
C No. 1.

C 1) Set data selector to WAY PT.

C 2) Enter N1574 on data keys.

C 3) Press INSERT key. 1574 appears in both data
C displays.

C 4) Set data selector to DIS/TIME. (Baro altitude
C from CADC)

C (f) Verify that CDU for INS No. 1 indicates between
C 00XX 2126 and 77XX 3134 (X is any number).

C NOTE: Only 77 or 00 may be present as indicated.

C (g) Release No. 1 central air data computer self-test
C pushbutton.

C (h) Repeat Steps (e) thru (g) using central air data
C computer No. 2 and CDU's for INS No. 2 and INS No.
C 3.

C (i) Return each INS to normal by performing following
C on each control/display unit.

C 1) Set data selector to POS.

C 2) Press WY PT CHG key.

C 3) Enter 01 on data keys so FROM-TO displays 0 1.

C 4) Press INSERT key.

C (j) Press and hold No. 1 and No. 2 central air data
C computer self-test push buttons and wait for
C Captain's (F/O'S) altimeter flags to disappear.
C Observe the CDU's for INS No. 1, No. 2 and No. 3
C and select WIND. Check that the WIND displays
C (right display) agrees approximately (within 12
C knots) with the TAS indicator on the center
C instrument panel. Release both CADC test buttons.

C (k) If INS is no longer required, restore airplane to
C normal.

C (5) Test Inertial Navigation System/HSI Interface

C (a) If required, prepare for test as described in
C Paragraph 20.

C (b) Position the following switches:

C 1) RNAV ALTN switch to normal (extinguished)
C position (Capt 1-F/O 2)

C 2) RADIO/INS switch to INS (forward pedestal)

C 3) Data selector switch to WIND (pilots control
C stand)

C 4) INS Mode Selector to ALIGN

C NOTE: Alignment mode status must be 8 or less
C prior to this step.

C (c) Press and hold TEST switch on control/display
C unit. Observe the following indications on
C appropriate HSI.

C 1) HDG flag and NAV annunciator are out of view.

C 2) Course pointer and 0 on azimuth card are
C positioned under lubber line. Course window shows
C 000. (If installed)

C 3) Course deviation bar is positioned one dot to
C right of center.

C 4) ALERT light illuminates.

5) Digital data DISTANCE, GND SPD, and TIME show 8's.

6) ALERT annunciator illuminates.

7) To-From pointer indicates TO.

8) INS COMPARATOR light for respective INS illuminates on forward center pedestal.

(d) Release Test Switch.

(6) Test Inertial Navigation System/ADI Interface

NOTE: The following test uses gimbal slew procedures.

(a) If required, prepare for test as described in Paragraph 2 D.

(b) Prepare for gimbal slew.

1) Turn each MSU mode selector switch to OFF.

2) Remove four screws, four washers, access coverplate, and gasket from J28 on each navigation unit front panel. Retain all items for reinstallation.

3) Insert gimbal slew test enable connector assembly. Delco Electronics P/N 7888466, into test connector J28 on each navigation unit.

4) Set each MSU mode selector switch to ALIGN. Verify that WARN lamp on each CDU lights.

5) Set each CDU data selector to DSRTK/STS. Verify that action code 00 is displayed in position Y Y of all right-hand displays (OYY-X5).

6) Load present position in accordance with following procedure.

a) Set CDU data selector to POS.

b) Press N2 or S8 key for north or south present position latitude.

c) Verify that 000°00.0 followed by correct letter (N or S) appears in left-hand display.

d) Press numbered keys in sequence for present position latitude.

e) Verify that correct latitude appears in left-hand data display.

NOTE: Numbers shift to left in data display as each additional number is loaded. If incorrect data is displayed, press CLEAR key and repeat Steps b) through e).

f) Press INSERT key.

1 Check that INSERT key remains lighted.

2 Verify that correct latitude, within 0.1 arc-minute is displayed in left-hand data display.

g) Press W4 or 6E key for west or east present position longitude.

h) Verify that 000°00.0 followed by correct letter (W or E) appears in right-hand display.

i) Press numbered keys in sequence for present position longitude.

j) Verify that correct longitude appears in right-hand data display.

NOTE: If incorrect longitude data is displayed, press CLEAR key and repeat Steps g) through j).

k) Press INSERT key.

l) Verify that INSERT light goes out; if INSERT light does not go out, repeat Steps a) through k).

7) Press to illuminate HOLD light. Verify that HOLD light stays on.

8) Repeat Steps 6) and 7) for No. 2 INS using No. 2 INS CDU.

9) Repeat Steps 6) and 7) for No. 3 INS using No. 3 INS CDU.

10) Set each CDU data selector to DSRTK/STS and allow each INS to align until actual PI number reaches 6. Note that NAV WARNING flag on HSI retracts.

NOTE: PI number is located in position X on right-hand data display (OYY-X5).

Slew capability can be initiated only when system PI is equal to 6.

11) When the PI for each INS reaches 6, set CDU data selector for that INS to POS. Check that after approximately 15 seconds, both left-hand and right-hand data displays drive to approximately zero.

NOTE: Expect some oscillation of two least significant digits on both displays during gimbal slew operations.

During gimbal slew operations, malfunction code 15 will appear in right-hand data display when CDU selector is set to DRSTK/STS. This is normal.

(c) Set CAPT's and F/O's ATT ALTN switches to NORM position (released).

(d) Slew INS platform about its pitch axis.

NOTE: Perform the following steps with the No. 1 INS CDU.

1) Set Auto/Manual switch to AUTO position.

2) Set REMOTE light to OFF (for pitch up) (Tape moves down).

NOTE: If REMOTE light is ON, INS will pitch down. (Tape moves up).

3) Extinguish HOLD light to start pitch slewing.

NOTE: During this test, computer limits pitch angle to 71 degrees. At this angle computer will cease gimbal slewing and downmode to course level (PI = 0). If this occurs, set MSU mode selector to OFF, allow 2 minutes for gyros to stop spinning, and then turn INS on again. Allowing INS to realign to mode 6 (present position must be inserted) will ensure proper gimbal zeroing, reset all malfunction circuits and erase permanent malfunction code list.

4) Monitor left-hand display for pitch attitude display. Display indicates degrees, minutes, and tenths of minutes. Sign for pitch attitude displacement is indicated by N = Pitch Up (Tape moves down). S = Pitch Down (Tape moves up).

NOTE: The maximum pitch rate is approximately 2.0 degrees per minute.

5) When 5-degree pitchup is achieved, stop pitch slewing by illuminating HOLD light.

6) Verify that ADI ball pitches to angle displayed on CDU.

(e) Slew INS platform about its roll axis.

1) Set AUTO/MAN switch to MAN.

2) Set REMOTE light to OFF (for right roll) (Tape rotates couterclockwise).

NOTE: If REMOTE light is ON, INS will roll left (Tape rotates clockwise)

3) Extinguish HOLD light to start roll slewing.

NOTE: During this test, computer limits roll angle to 71 degrees. At this angle, computer will cease gimbal slewing and downmode to course level (PI = 8). If this occurs, set MSU mode selector to OFF, allow 2 minutes for gyros to stop spinning, and then turn INS on again. Allowing INS to realign to mode 6 (present position must be inserted) will ensure proper gimbal zeroing, reset all malfunction circuits, and erase permanent malfunction code list.

4) Monitor right-hand display for roll attitude displacement. Display indicates degrees, minutes, and tenths of minutes. Director of roll attitude displacement is indicated by E = Right Roll (Tape rotates counterclockwise) W = Left Roll (Tape rotates clockwise).

NOTE: Maximum roll rate is approximately 2 degrees per minute.

5) When 10-degree right roll is achieved, stop roll slewing by illuminating HOLD light.

C (f) Verify that CAPT's ADI displays 5-degree pitchup
C and 10-degree right roll.

C (g) Open VG/INS-1(G6) circuit breaker. Check that
C CAPT's ADI attitude flag comes in view.

C (h) Close VG/INS-1(G6) circuit breaker. Check that
C CAPT's ADI attitude flag disappears from view.

C (i) Set CAPT's ATT ALTN to ALTN position (depressed).

C (j) Repeat Step (d) using No. 3 INS CDU. Allow pitch
C slew to continue until 15-degree pitchup is
C achieved.

C (k) Repeat Step (e) using No. 3 INS CDU. Stop roll
C slew when 5-degree right roll is achieved.

C (l) Verify that CAPT's ADI displays 15-degree pitchup
C and 5-degree right roll.

CR (m) Open INS 3/GYRO-3 (E24) on 018 thru 031 or VG/INS
CR 3 (E25) circuit breaker on 032 and on. Check that
C CAPT's ADI attitude flag comes in view.

CR (n) Close INS 3/GYRO-3 (E24) on 018 thru 031 or VG/INS
CR 3 (E25) circuit breaker on 032 and on. Check that
C CAPT's ADI attitude flag disappears from view.

C (o) Set F/O's ATT ALTN switch to ALTN position
C (depressed). Check that F/O's ADI displays
C 15-degree pitchup and 5-degree right roll.

C (p) Return CAPT's ATT ALTN switch to NROM position.
C Check that CAPT's ADI display 5-degree pitchup and
C 10-degree right roll.

CR (q) Open INS 3/GYRO-3 (E24) on 018 thru 031 or VG/INS
CR 3 (E25) circuit breaker on 032 and on. Check that
C F/O's ADI attitude flag comes in view.

CR (r) Close INS/GYRO-3 (E24) on 018 thru 031 or VG/INS 3
CR (E25) circuit breaker on 032 and on. Check that
C F/O's ADI attitude flag disappears from view.

C (s) Set F/O's ATT ALTN switch to NORM position
C (Released).

C (t) Repeat Step (d) using No. 2 INS CDU. Stop pitch
C slew when 10-degree pitchup is achieved.

C (u) Repeat Step (e) using No. 2 INS CDU. Allow roll
C slew to continue until 15-degree right roll is
C achieved.

C (v) Verify that the F/O's ADI displays 10-degree
C pitchup and 15-degree right roll.

CR (w) Open INS/VERT GYRO (G24) (No. 2 INS) on G18 thru
CR G31 or INS 2 (G25) circuit breaker on G32 and on.
C Check that F/O's ADI attitude flag comes in view.

CR (x) Close INS/VERT GYRO (G24) (No. 2 INS) on G18 thru
CR G31 or INS 2 (G25) circuit breaker on G32 and on.
C Check that F/O's ADI attitude flag disappears from
C view.

C (y) Post Gimbal Slew Test Procedures

C 1) Remove gimbal slew test connectors from J28 on
C front of each navigation unit and replace J28 test
C connector access coverplates.

C 2) Set all data selector switches to DSRTK/STS
C position. Verify that INS downmodes to course
C level (PI = 8).

C (z) If INS is no longer required, restore airplane to
C normal.

C (7) Test Inertial Navigation System/Autopilot Flight
C Director System Interface

C (a) If previous tests were not performed, prepare for
C this test as described in Paragraph 2. D. above.
C Perform AFCS Operation-General Test, 22-00-00,
C Table 501 of L-1011 Maintenance Manual.

C (b) Check that all autopilot/flight director system's
C circuit breakers are closed (pushed in).

C (c) Check that all aircraft control surfaces are clean
C for movement without danger to personnel or
C aircraft damage.

C (d) Rotate all INS Mode Selector switches to ALIGN.

C (e) Select DSRTK/STS on all INS CDUs and check that
C status has reached "0XX75."

C (f) On No. 1 and No. 2 INS CDUs, check that data
C selector switch is positioned to WIND position.

C (g) Check that all autopilot/flight director components are installed and operating to allow R NAV (INS) autopilot coupling.

C (h) On No. 1 INS CDU, check that the AUTO/MAN switch is positioned to MAN.

C (i) Press and hold INS No. 1 CDU TEST button.

C (j) Raise Autopilot A bat handle to COMMAND and press NAV button on Autopilot Control Panel on glareshield. Check that control wheels turn clockwise for a right turn and NAV button illuminates and that both AFCS mode panels read RNAV.

C (k) Engage FD No. 1 and FD No. 2 to ON. Check that Captain's command bars come into view and command a right turn. Select FD ALTN on F/O's lower instrument panel. Check that F/O's command bars come into view and command a right turn.

C (l) Release No. 1 INS CDU TEST button. Check that Autopilot A bat handle drops to CWS and autopilot control panel NAV light remains lighted.

C (m) Press Autopilot NAV button to release and extinguish NAV legend.

C (n) On No. 1 INS CDU, rotate AUTO/MAN switch to AUTO. Press and hold INS No. 1 CDU TEST button.

C (o) Raise Autopilot A bat handle to COMMAND and press NAV button on Autopilot Control Panel on glareshield. Check that control wheels turn counterclockwise for a left turn, that the NAV button illuminates and that both AFCS mode panels read RNAV.

C (p) Check that FD No. 1 and No. 2 are ON. Check that Captain and F/O's command bars come into view and command a left turn.

C (q) Release No. 1 INS CDU TEST button. Check that Autopilot A bat handle drops to CWS and autopilot control panel NAV light remains lighted. Disconnect Autopilot A to OFF. Depress autopilot NAV button to release and extinguish NAV legend. Select FD No. 1 and No. 2 to OFF. Check that RNAV legend in both AFCS mode panels disappears.

C (r) Press F/O's FD ALTN source select button to release and extinguish ALTN legend. Press Captains's FD ALTN source select button to depressed position (ALTN lighted).

C (s) On the No. 2 INS CDU, select AUTO/MAN switch to MAN. Press and hold No. 2 INS CDU TEST button.

C (t) Raise Autopilot B bat handle to COMMAND and press NAV button on Autopilot Control Panel on glareshield. Check that control wheels turn clockwise for a right turn, that NAV button illuminates and that both AFCS mode panels read RNAV.

C (u) Engage FD No. 1 and FD No. 2 to ON. Check that Captain and F/O's command bars come into view and command a right turn.

C (v) Release No. 2 INS CDU TEST button. Check that Autopilot B bat handle drops to CWS and autopilot control panel NAV light remains lighted.

C (w) On No. 2 INS CDU, select AUTO on AUTO/MAN switch. Press and hold INS No. 2 CDU TEST switch.

C (x) Raise autopilot B bat handle to COMMAND. Check that control wheels turn counterclockwise for a left turn and that AFCS mode panels read RNAV.

C (y) Release No. 2 INS CDU TEST button. Check that Autopilot bat handle drops to CWS. Disconnect B Autopilot to OFF. Select OFF on FD No. 1 and No. 2 selector switches.

C (z) Switch INS MSU No. 1, No. 2, and No. 3 to NAV. Check that NAV READY lamp illuminates on all three MSUs. Select DSRTK/STS on No. 1, No. 2, and No. 3 INS CDU data selector switches. Check that the right-side CDU data display shows "1" in left-most digit.

C (aa) Check that the Captains's and F/O' HSI NAV flags go out of view and HDG flag changes to TRUE.

C (bb) Raise Autopilot A bat handle to CWS and check that it remains engaged. Lower Autopilot A bat handle to OFF. Raise Autopilot B bat handle to CWS and check that it remains engaged. Lower Autopilot B bat handle to OFF.

C (cc) If INS is no longer required, restore airplane to
C normal per Paragraph 2. F. below.

C F. Restore Airplane to Normal

C (1) Place each INS mode selector switch in OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE
C INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND
C DEPLETE INS BATTERY. WITHOUT FESC EQUIPMENT
C COOLING THE INS WILL OVERHEAT AND REQUIRE
C REPLACEMENT.

C (2) Remove electrical power if no longer required. Refer
C to 24-00-00.

C (3) Remove equipment cooling if no longer required. Refer
C to 21-25-00.

C INS_MODE_SELECTOR_UNIT_-_SERVICING_(RELAMPING)

C 1. General

C A. The INS mode selector units (MSU) are located in the pilots overhead panel. Individual lamps and the illuminated panel may be replaced while the INS is operating, without affecting the system alignment or operation.

C 2. Relamp_MSU_Annunciators_(Fig._301)

C A. Equipment and Material

C (1) Lamp - 28 volts, 40 ma, type MS18209 (preferred) or MS25237-327

C B. Replace Lamp

C (1) Unscrew annunciator lens cap and remove (Fig. 301).

C (2) Pull lamp from lens cap.

C (3) Insert new lamp in lens cap.

C (4) Reinstall lens cap (green lens cap in READY NAV and red lens cap in BAT annunciator).

C (5) Perform Step 4 (Test MSU Lamp).

C 3. Relamp_MSU_Illuminated_Panel

C A. General

C (1) Lamps providing illumination in this panel cannot be replaced. The panel assembly must be replaced.

C B. Equipment and Materials

C (1) Fiber screwdriver-tipped tool for prying

C (2) Torque screwdriver - 0 to 5 inch-pound range, small bit

C (3) Illuminated Panel Assembly - Delco Electronics, P/N 7883748.

C C. Replace Illuminated Panel (Fig. 301)

(1) Set the PANEL LIGHTS control to the OFF position on the pilots overhead panel.

(2) Loosen two setscrews in mode selector switch knob and pull knob from shaft.

(3) Unscrew both annunciator lens caps and remove.

(4) Loosen two cross-recessed captive fasteners and disengage coaxial connector (underneath + on panel) by prying illuminated panel and front panel apart.

CAUTION: USE FIBER SCREWDRIVER TIPPED TOOL TO AVOID DAMAGE TO PANELS.

(5) Install replacement illuminated panel by pressing firmly on the + to engage connector and by tightening two captive fasteners. (Torque to 2.0-2.5 inch-pounds.)

(6) Check that both lens caps have lamps installed and screw green lens cap into READY NAV annunciator and red lens cap into BAT annunciator.

(7) Install mode selector switch knob and tighten both setscrews.

CAUTION: DO NOT JERK THE PANEL OR PULL AGAINST THE WIRES ATTACHED TO THE EDTE LIGHTING PLUG AS THE WIRES MAY BREAK OR PULL AWAY FROM INTERNAL CONNECTIONS, OR THE PLUGS OR PANEL ASSEMBLY MAY BE DAMAGED.

CAUTION: DO NOT, OVERTIGHTEN THE SCREW ASSEMBLIES BECAUSE THE PANEL ASSEMBLY MAY WARP OR BREAK.

4. Test MSU Lamps

A. Provide instrument panel lighting power (33-00-00).

B. Check that illuminated panel lights on the MSU when panel lighting power is applied to pilots overhead panel.

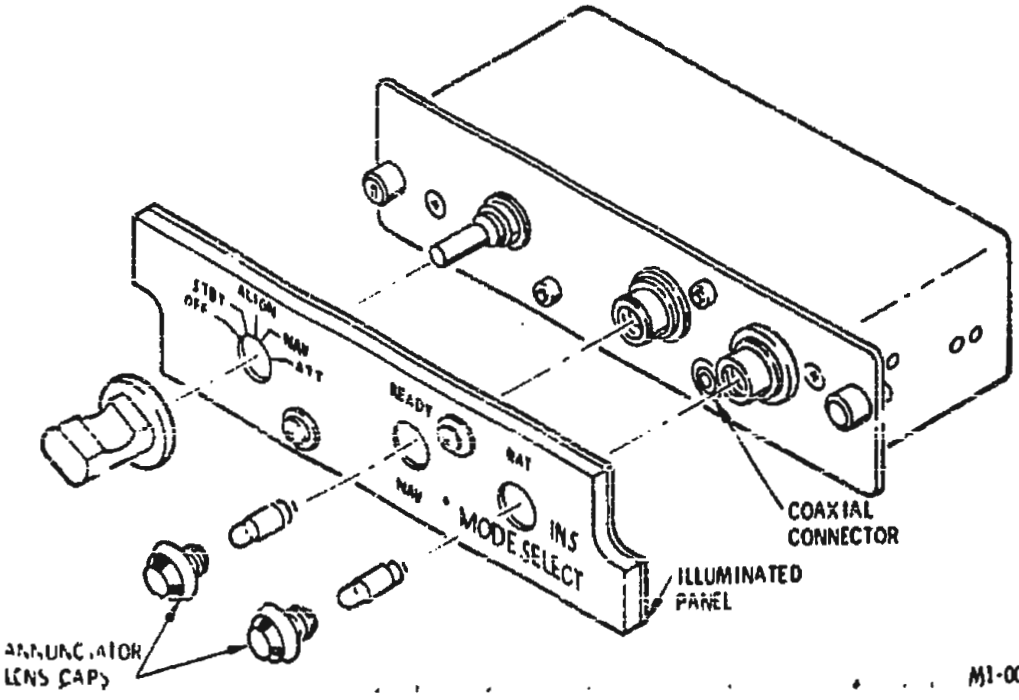
C. Vary intensity of pilots overhead panel lighting and observe that illuminated panel varies accordingly.

D. On MSU, check that mode selector switch is in any ON position.

E. Set the appropriate CDU data selector switch to the DSRTK/STS position.

C F. Momentarily press the CDU TEST switch and observe that both
C annunciator lamps illuminate.

C G. If INS is no longer needed, set mode selector switch to OFF
C and restore airplane to normal.



C Mode Selector Unit - Relamping Disassembly
C Figure 301

INS MODE SELECTOR UNIT - REMOVAL/INSTALLATION

1. General

A. The INS mode selector units (MSU) are located on the flight deck in the pilots overhead panel. Each unit is held in place by two quick-release fasteners and has one electrical cable attached to the rear panel through a connector.

NOTE: The MSU individual lamps and illuminated panel may be replaced while the INS is operating, without effecting system operation. Use 34-43-01, Mode Selector Unit - Servicing (Relamping).

B. Prior to unit removal:

(1) Set mode selector switch (on appropriate mode selector unit) and PANEL LIGHTS control (pilots' overhead panel) to OFF position

(2) Open circuit breaker on front panel of appropriate battery unit (located in rack between forward and center racks in FESC).

C. After installation, close circuit breaker on front panel of battery unit.

D. Test by performing INS turn-on check and lamp test. Refer to 34-43-01. INS Mode Selector Unit - Adjustment/Test (Turn-on check and lamp test).

C INS MODE SELECTOR UNIT - ADJUSTMENT/TEST

C 1. INS Mode Selector Unit Test

C A. General

C (1) The INS mode selector units (MSU) are located on the C flight deck in the pilots overhead panel. This test C provides a rapid check of the mode selector unit C (MSU)/navigation unit interface and of the MSU signals C to the navigation moding logic.

C B. Referenced Procedures

C (1) 21-25-00, Equipment Cooling - Adjustment/Test C (Operating Test)

C (2) 24-00-02, Manual Control - Maintenance Practices (Apply C Power)

C (3) 33-00-00, Pilots Panel Lights System - Adjustment/Test C (Operational Test)

C C. Prepare for Test

C (1) Set mode selector switch on each MSU in pilots overhead C panel to OFF position.

C (2) Apply aircraft power. Refer to 24-00-00.

C (3) Provide instrument panel lighting power. Refer to C 33-00-00.

C (4) Supply equipment cooling. Refer to 21-25-00.

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION C UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE C ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF C NAVIGATION UNITS.

C (5) Ensure inertial navigation system to be tested has C battery, navigation, control/display and mode selector C units properly installed.

C (6) On the pilots overhead circuit breaker panel CB1, C verify that the listed circuit breakers are closed for C INS being tested:

CR INS-1
CR ----------
CR VG/INS 1 (G6) No. 1 Navigation
CR INS PWR (E6) No. 1 Nav & Instr
CR INS HTR (E7) No. 1 Nav & Inst

CR INS-2
CR ----------
CR INS/VERT GYRO (G24) No. 2 Navigation
CR INS HTR (G25) No. 2 Navigation

CR INS-3
CR ----------
CR INS 3/GYRO 3 (E24) No. 2 Nav & Inst
CR INS 3 HTR (E25) No. 2 Nav & Inst
C ----------

C (7) Close circuit breakers on front panel of appropriate
C INS battery unit.

C D. Test Mode Selector Unit

C (1) Rotate PANEL LIGHTS control on pilots overhead panel
C and check that MSU panel illumination changes
C intensity.

C (2) Turn-on check and lamp test.

C (a) Set mode selector on appropriate MSU to ALIGN. On
C control/display unit (C/DU) and MSU check that:

C 1) Red, amber and green lamps do not illuminate.

C NOTE: Some lights, including the red WARN light
C and green READY NAV light, may flash
C briefly at turn-on.

C 2) C/DU INSERT key is illuminated.

C 3) C/DU FROM-TO display shows 0 1.

C (b) Place data selector on appropriate C/DU TO POS and
C press and hold TEST switch. Check that:

C 1) All keys (except keyboard and CLEAR keys) and
C lamps on C/DU and MSU illuminate.

C 2) Numerals 88°88.8 N/S are displayed in
C left-hand data display.

C 3) Numerals 88°88.8 E/W are displayed in
C right-hand data display.

C 4) Numerals 8 8 are displayed in FROM-TO display.

C E. Restore Airplane to Normal

C (1) Set each INS mode selector switch to OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE
C INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND
C DELETE BATTERY.

C (2) Remove electrical power if no longer required. Refer
C to 24-00-00.

C (3) Remove equipment cooling if no longer required. Refer
C to 21-25-00.

C INS CONTROL/DISPLAY UNIT - SERVICING (RELAMPING)

C 1. General

CR A. The INS control/display units (CDU) are located on center
CR console. Individual lamps, data displays and the
C illuminated panel may be replaced while the INS is
C operating, without affecting the system alignment or
C operation.

C B. The only exception is the illuminated waypoint thumbwheel.
C This lamp cannot be changed on the flight line.

C 2. Relamp CDU Keys and Annunciators (Fig. 301 and 302)

C A. Equipment and Material

C (1) Lamp, 28 volts, 40 ma -- Type MS18209-387 (preferred)
C or MS25237-327

C (2) Lamp, 14 volts, 80 ma -- AC Electronics, P/N
C 7890382-001 (MS25237-382)

C (3) Lamp, 6 volts, 200 ma -- Type MS25237-328

C B. Replace Lamp

C (1) Unfasten three clips on indicator access panel and
C remove panel (Fig. 301).

C (2) Pull annunciator lamp cover or key from socket.

C (4) Insert new lamp in lamp cover or key. Refer to Fig.
C 302 for correct lamp size.

C CAUTION: WHEN RELAMPING, USE CARE TO INSTALL CORRECT TYPE
C LAMP. ONLY 28-VOLT LAMPS ARE USED IN BATT AND
C WARN ANNUNCIATORS. FAILURE TO USE CORRECT BULB
C CAN CAUSE TRANSISTOR BURNOUT IN NAVIGATION UNIT.

C (5) Reinstall lamp cover or key.

C (6) Reinstall access panel and fasten three clips.

C (7) Perform Step 5 (Test CDU Lamps)

C 3. Relamp CDU Data Display Indicators (Fig. 301, 303, and 304)

C A. Equipment and Materials

C (1) Vise-grips -- Modified as shown in Figure 303

C (2) Lamp Module Block -- Delco Electronics, P/N 8596991-105
C with replaceable lamps. (Type 3)

C (3) Lamp Module Block -- Delco Electronics, P/N 8596991-106
C with replaceable lamps. (Type 4)

C (4) Lamps, individually replaceable -- Delco Electronics,
C P/N 8596991-201

C B. Relamp Data Display Indicator (CDU P/N 7883460)

C (1) Unfasten three clips on indicator access panel and
C remove panel (Fig. 301).

C (2) Remove data display indicator from CDU front panel.

C CAUTION: USE MODIFIED VISE-GRIP PLIERS. CLAMP PLIERS
C (PROPERLY ADJUSTED) CAREFULLY AND PULL STRAIGHT
C OUT PERPENDICULAR FROM PANEL SURFACE TO PREVENT
C DAMAGE TO INDICATOR AND CDU.

C (3) Release data display lamp module retainer clip.
C (Retainer is a screw for 2-digit display
C (Fig. 304)

C (4) Remove defective lamp module block from data display
C indicator.

CR (5) If applicable, remove replaceable lamp from its socket
CR in lamp module block and replace with new lamp.

CR (6) Insert new lamp module block into data display
CR indicator.

CR (7) Fasten lamp module retainer to normal position.

CR (8) Insert relamped data display indicator in CDU front
CR panel socket.

CR (9) Reinstall access panel and fasten three clips.

CR (10) Perform Step 5 (Test CDU Lamps).

C NOTE: Remove defective lamp module block from aircraft
C and relamp as necessary using P/N8596991-201
C lamp and return to stock; or return defective

C lamp module block to MCI Instrument Shop for
C relamping. See Step 6 for testing and relamping
C defective lamp module blocks with GEN 3564
C Tester.

C C. Relamp Data Display Indicator for CDU P/N 7891390

C NOTE: When installed, the only appearance change with CDU
C P/N 7883460 is two visible captive screws on the
C from/to display and a white dot on upper right cover
C of DCU face plate.

C (1) Unfasten three clips on indicator access panel and
C remove panel (Fig. 305, Sheet 1).

C (2) Loosen one captive screw for the LAT/LONG display or
C two captive screws for the FROM/TO display and pull-out
C the display face.

C (3) REMOVE REPLACEABLE LAMP FROM ITS SOCKET, USING MODIFIED
C TWEEZERS (Ref. Fig. 303) and replace with new lamp.

C (4) Re-install LAT/LONG display or FROM/TO display as
C required.

C (5) Re-install access panel and fasten three clips.

CR (6) Perform Step 5 (test CDU lamps).

C 4. Relamp CDU Illuminated Panel

C A. General

C (1) Lamps providing illumination in this panel cannot be
C replaced on the flight line. The panel assembly must
C be replaced.

C B. Equipment and Materials

C (1) Fiber screwdriver - tipped tool for prying

C (2) Glyptal - General Electric 7526

C (3) Torque screwdriver - 0 to 5 inch-pound range, small bit

C (4) Illuminated Panel Assembly - AC Electronics, P/N
C 7883574

C C. Replace Illuminated Panel (Fig. 301 or 305 [Sheet 1]).

C (1) Loosen two setscrews in AUTO-MAN/TEST switch knob and pull knob from shaft.

C (2) Loosen two setscrews in DIM control knob and pull knob from shaft.

C (3) Loosen two setscrews in data selector switch knob and pull knob from shaft.

C (4) Loosen three cross-recessed captive fasteners and disengage coaxial connector (underneath "+" on panel) by prying illuminated panel and front panel apart.

C CAUTION: USE FIBER SCREWDRIVER-TIPPED TOOL TO AVOID DAMAGE TO PANELS.

C (5) Install replacement illuminated panel by pressing firmly on the "+" to engage connector and by tightening three captive fasteners to a torque of 7.8 to 8.7 inch-pounds.

C (6) Apply glyptal to setscrew threads in all three knobs.

C (7) Install data selector switch knob and torque both setscrews to 5.0 inch-pounds.

C (8) Install DIM knob and torque both setscrews to 3.0 inch-pounds.

C (9) Install AUTO-MAN/TEST switch knob and torque both setscrews to 3.0 inch-pounds.

C NOTE: Allow sufficient clearance between knob and panel so press-to-test function can be performed. (Approximately 3/16 in. clearance is req.)

C 5. Test CDU Lamps

C A. Provide instrument panel lighting power (Ref. 33-00-00).

C B. On CDU, check that illuminated panel and all data keys (include CLEAR) light when panel lighting power is applied to forward and aft control stand electronic panels.

C C. Vary intensity of control stand panel lighting and observe that illuminated panel and all data keys on CDU vary accordingly.

C D. Check that mode selector switch is in any "on" position.
C Check that INS equipment cooling is operating and providing
C adequate air flow.

C E. Set CDU data selector switch to the POS position.

C WARNING: IF TEST SWITCH IS PRESSED WHILE PI IS GREATER THAN 6
C (RIGHT DISPLAY, FIFTH DIGIT), DATA SELECTOR IS NOT IN
C DSTRK/STS AND INS MODE IS NOT NAV, THE AUTOPILOT IS
C AUTOMATICALLY SENT A COMMAND FOR RIGHT BANK. IF
C AUTOPILOT AND HYDRAULIC SYSTEMS ARE OPERATING, FLIGHT
C SURFACE MOVEMENT COULD OCCUR, ENDANGERING PERSONNEL.

C F. Momentarily press CDU TEST switch. While switch is
C depressed, observe that:

C (1) All control key and annunciator lamps illuminate.

C (2) Left-hand data display is indicating 88°88.8N/S.

C (3) Right-hand data display is indicating 888°88.8E/W.

C (4) FROM-TO display is indicating 8 8.

C (5) Intensity of all lamps in Steps (1) through (4) varies
C when the CDU DIM knob is turned.

C NOTE: This does not apply to the BAT and WARN
C annunciator lamps.

C (6) Set CDU data selector switch to HDG/DA position and
C observe:

C 1) degree symbol in both displays moves to right of
C last 8 and

C 2) decimal in right-hand display disappears.

C (7) Set CDU data selector switch to XTK/TKE position and
C observe in left-hand display that decimal symbol moves
C one digit left and degree symbol disappears.

C G. If INS is no longer needed, set each mode selector switch to
C OFF and restore airplane to normal.

C 6. Test CDU Lamp Module Blocks (Ref. Fig. 306)

C A. Equipment and Materials

C (1) INS CDU Lamp Module Tester - GEN 3564

C (2) Tweezers - Modified as shown in Figure 303.

C B. Test Lamps

C (1) Place INS CDU Lamp Module Block in the proper GEN 3564
C Tester socket (Ref. Fig. 306, Detail A). Check that
C all lamps light.

C NOTE: Insert Type 3 lamp module blocks in the left
C socket as shown by outline shape. Insert Type 4
C lamp module blocks in the right socket as shown
C by outline shape.

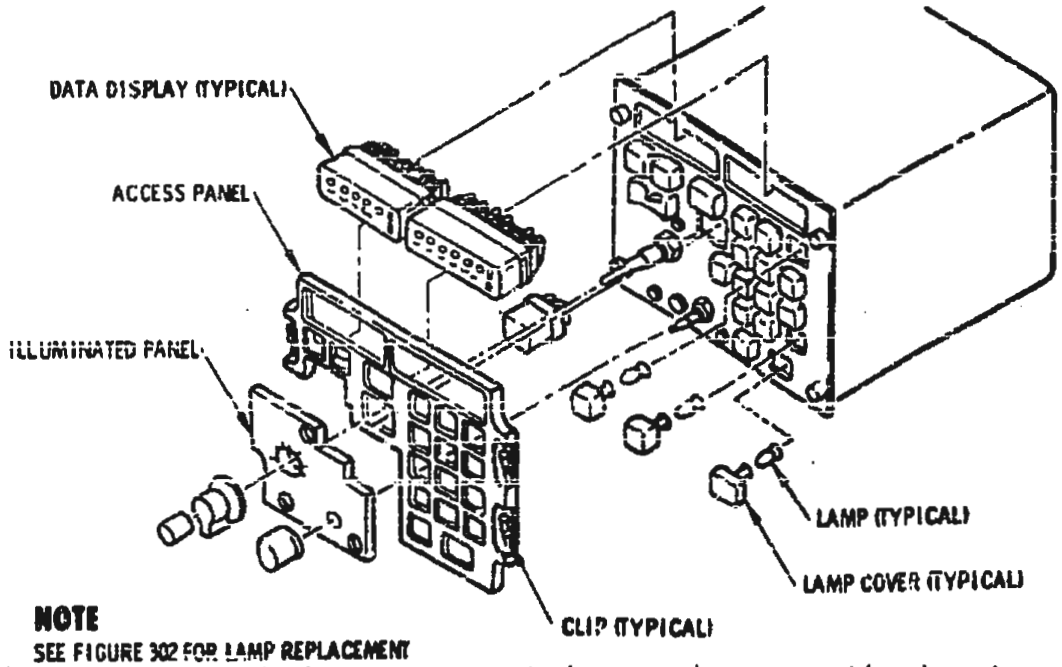
C (2) Remove defective individual lamp(s) using tweezers
C modified per Figure 303.

C (3) Insert new lamp in lamp module block.

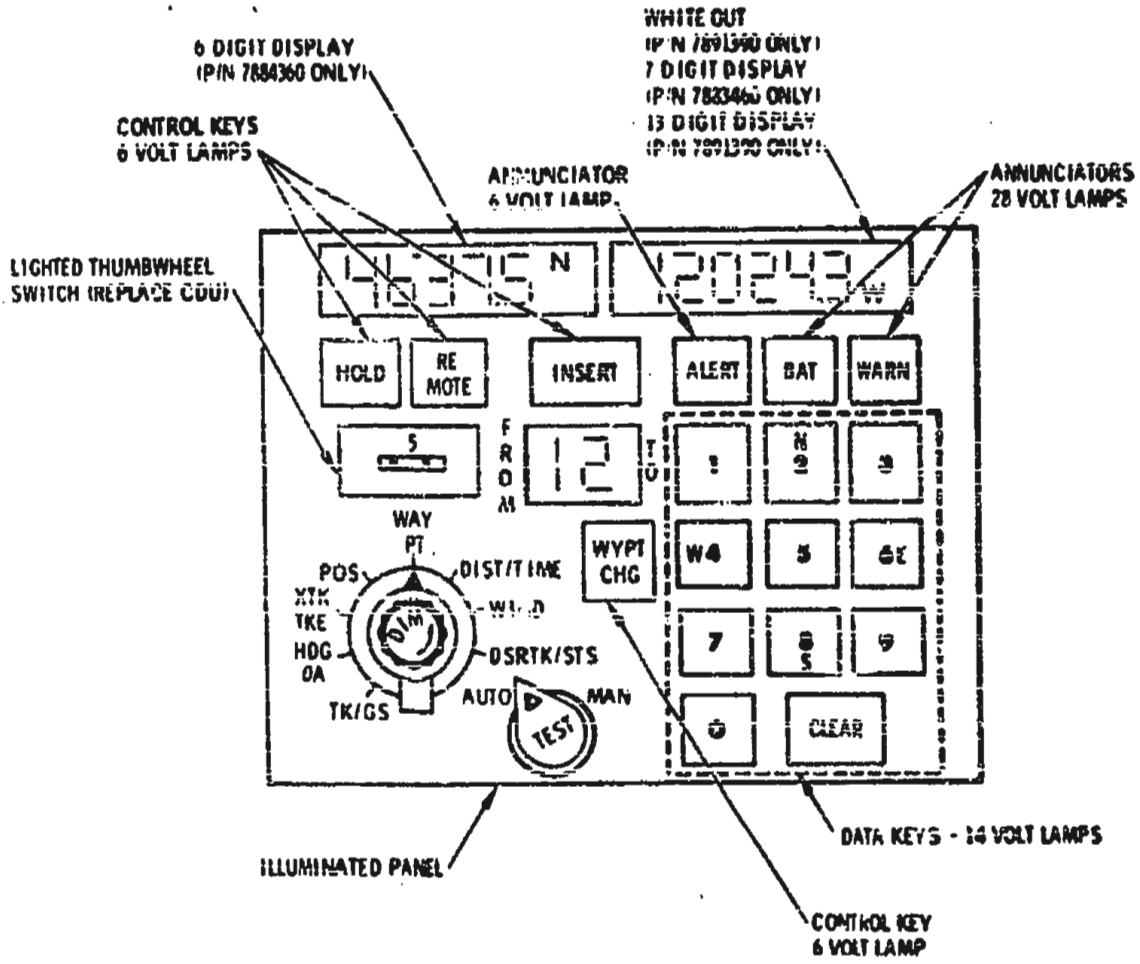
C (4) Test relamped lamp module block in proper GEN 3564
C socket and check that all lamps light.

C (5) Return relamped serviceable lamp module blocks to
C stock.

C NOTE: Stations that do not have a GEN 3564 Tester
C should collect lamp module blocks requiring new



C Control/Display Unit (P/N 7883460) - Relamping Disassembly
C Figure 301



LAMP	LAMP POSITION
328 (6V)	HOLD, REMOTE, INSERT, WYPT CHG, ALERT
382 (14V)	DATA KEYS - 1 THRU 9, CLEAR
387 (28V) OPT 327	BAT, WARN CAUTION: DO NOT INSTALL 6 VOLT OR 14 VOLT LAMPS IN BAT OR WARN POSITIONS

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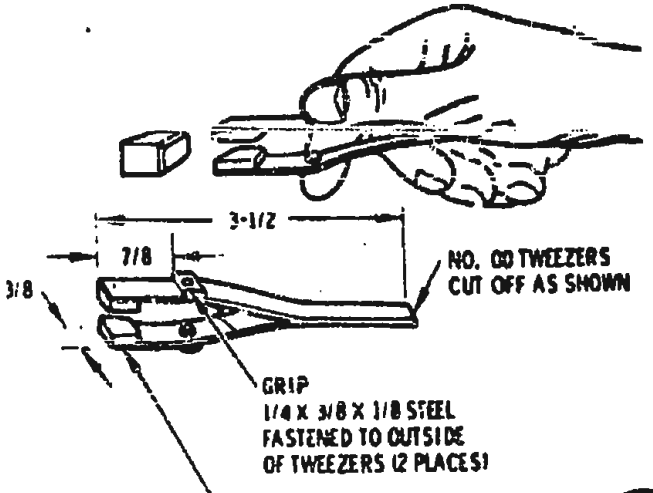
CR
CR

Control/Display Unit - Lamp Replacement
Figure 302

EFFECTIVITY: INS EQUIPPED AIRCRAFT

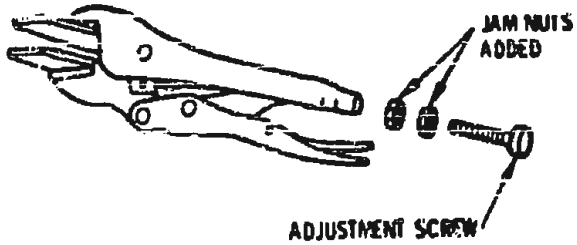
0028



ALL DIMENSIONS SHOWN IN INCHES. STD TOL. APPLIES

NOTE

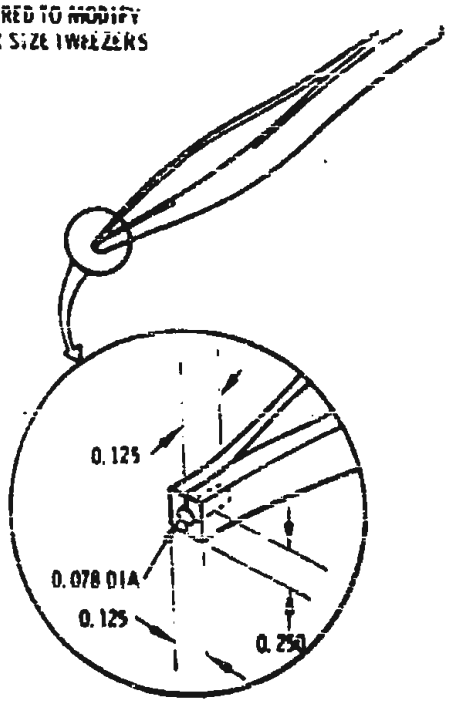
RECOMMENDED DIMENSIONS MAY BE CHANGED AS REQUIRED TO MODIFY OTHER SIZE TWEEZERS



NOTE

A NO-SLIP RESILIENT COATING MAY BE APPLIED TO THE INNER SURFACE OF VISE-GRIP JAWS TO ALLEVIATE POSSIBLE SLIPPING OR SCRATCHING OF AN INDICATOR

ADJUST UNCLAMPED JAWS TO JUST TOUCH INDICATOR . . THEN TIGHTEN ADJUSTMENT SCREW AN ADDITIONAL 1/8 TURN. TIGHTEN JAM NUTS TO VISE-GRIP FRAME TO LOCK JAWS IN THE ADJUSTED POSITION. THIS ADJUSTMENT SHOULD PREVENT EXCESSIVE PRESSURE ON AN INDICATOR



TWEEZERS MODIFIED FOR LAMP PULLING (USE ON P/N 8596991-201 ONLY)

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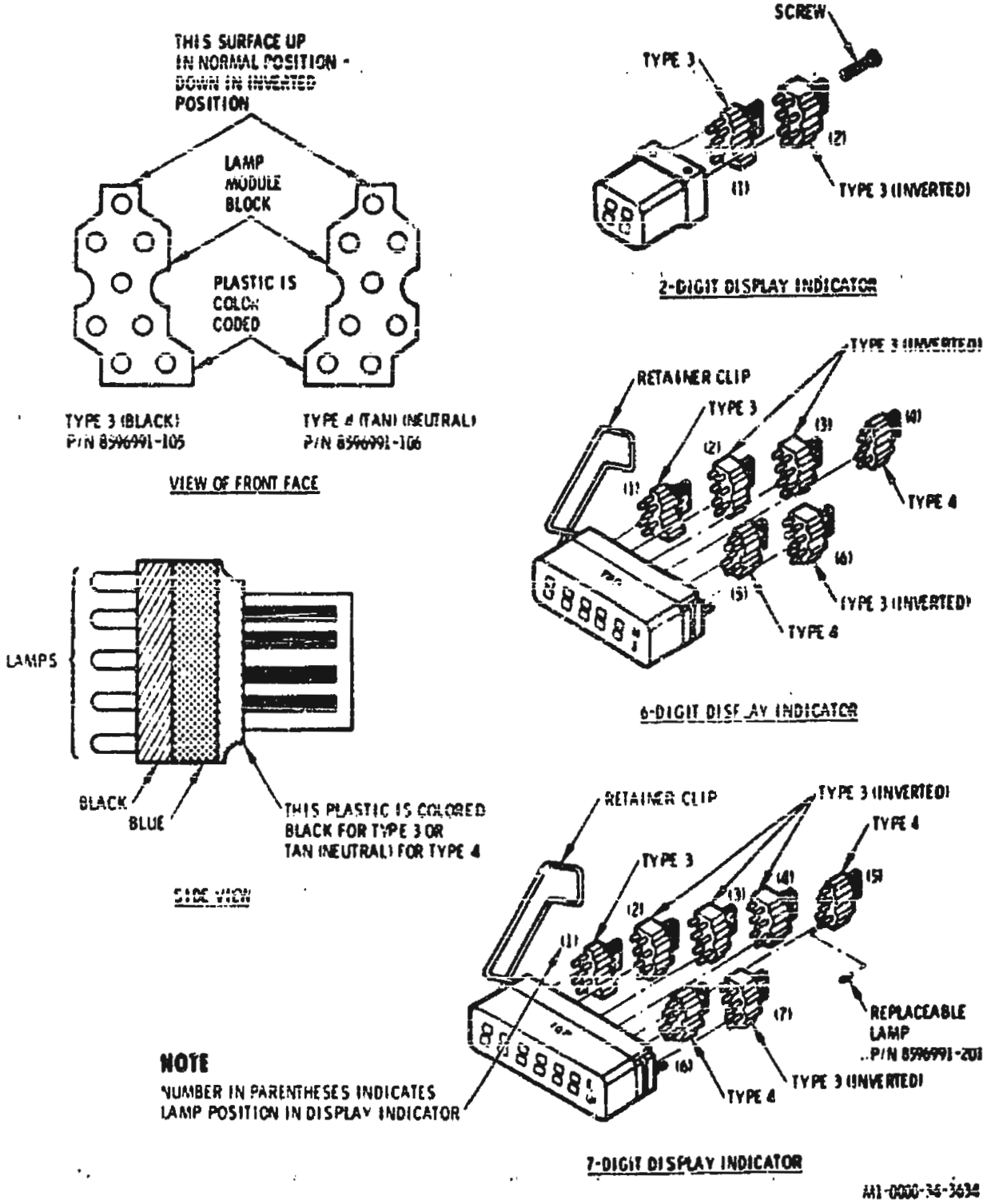
C
C

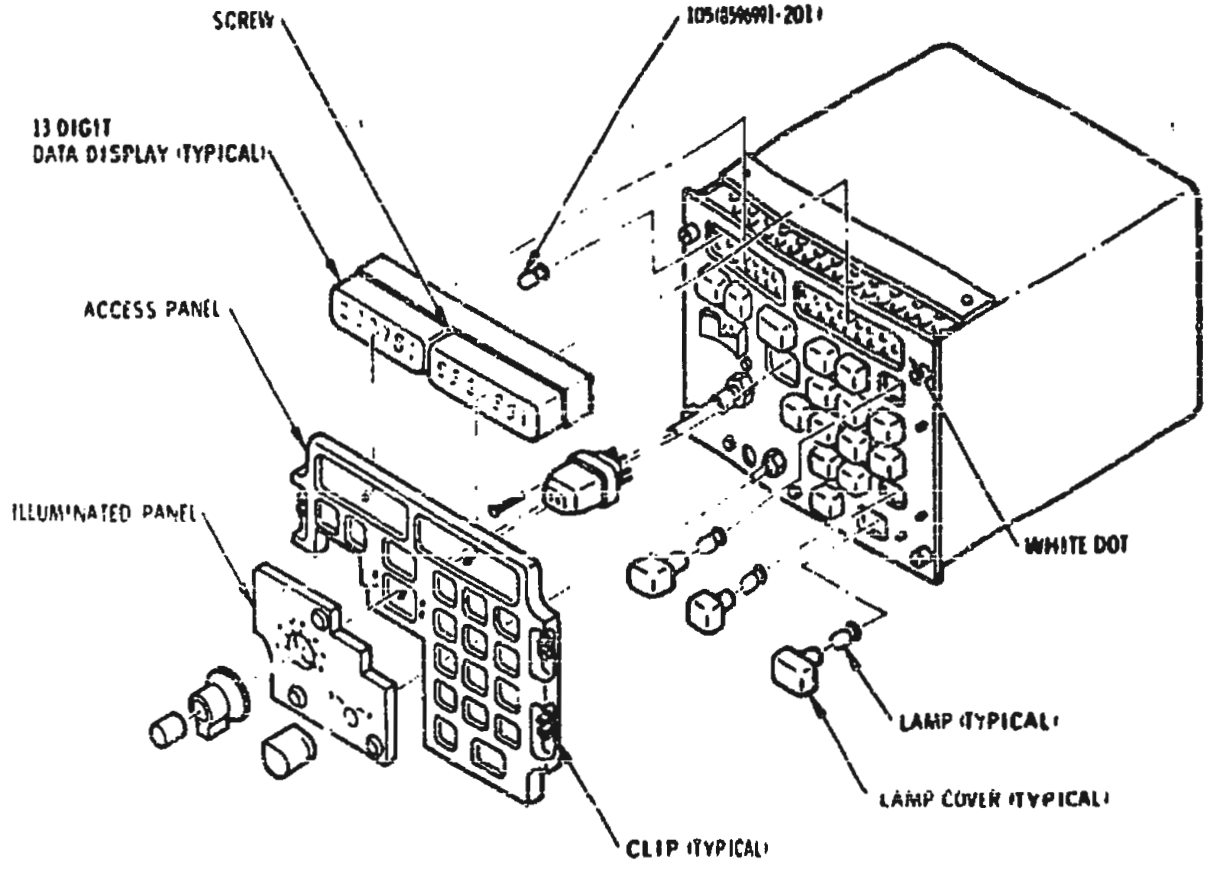
Relamping Tools
Figure 303



C Data Display Indicators - Lamp Replacement
C Figure 304

EFFECTIVITY: INS EQUIPPED AIRCRAFT

0028



NOTE
SEE FIGURE 302 FOR LAMP REPLACEMENT

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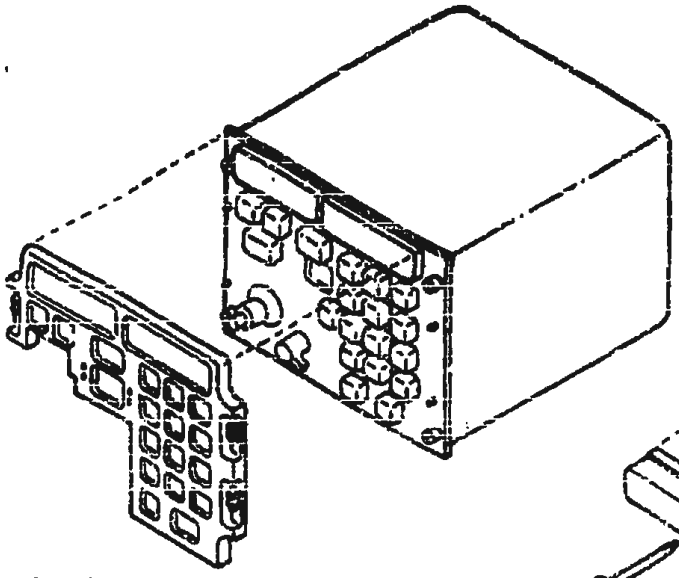
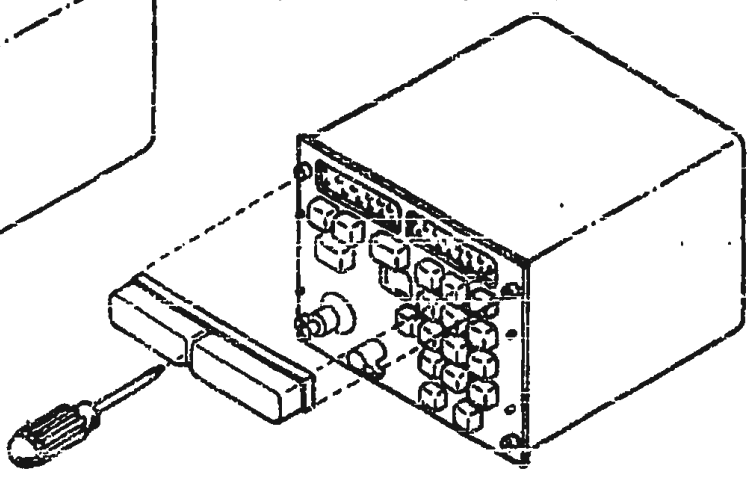
CR Control/Display Unit (P/N 7891390) - Relamping Disassembly
CR Figure 305 (Sheet 1)

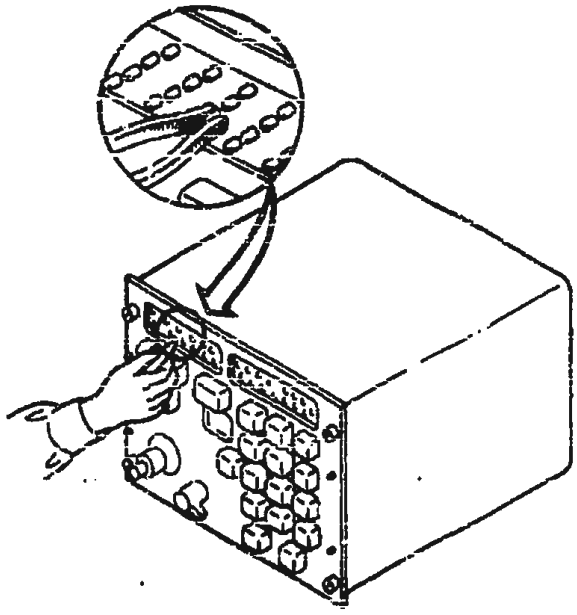
R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
002B



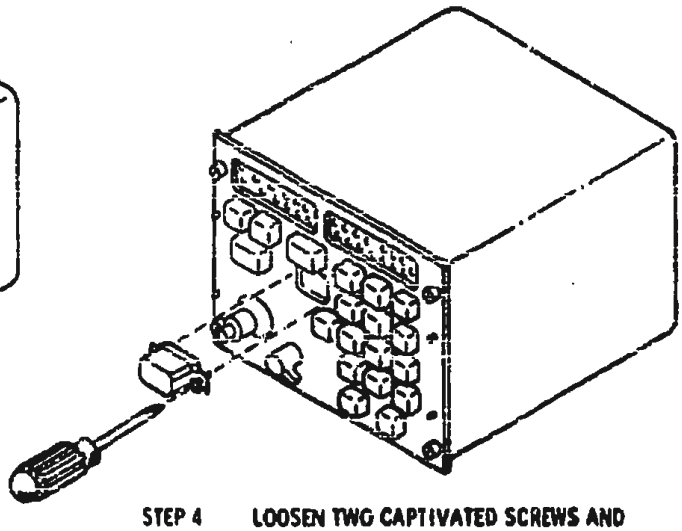
STEP 1 DISENGAGE THREE SLIDE FASTENERS AND REMOVE FRONT PANEL



STEP 2 LOOSEN CENTER CAPTIVATED SCREW AND REMOVE DISPLAY CAP



STEP 3 REMOVE LAMP(S) WITH MODIFIED TWEEZERS (P/N DT1973A)



STEP 4 LOOSEN TWO CAPTIVATED SCREWS AND REMOVE FROM-TO DISPLAY CAP. REPEAT STEP 3

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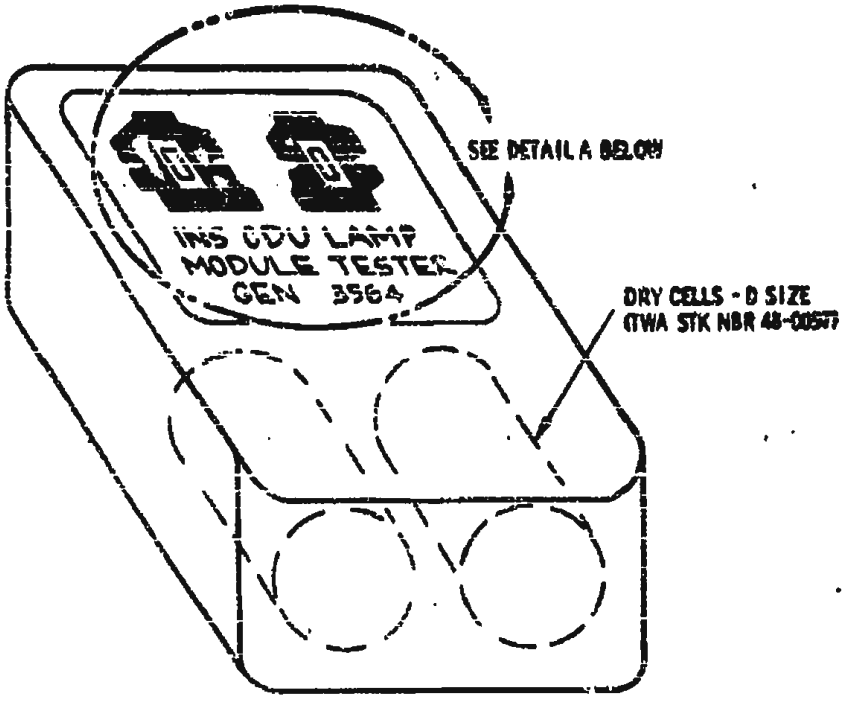
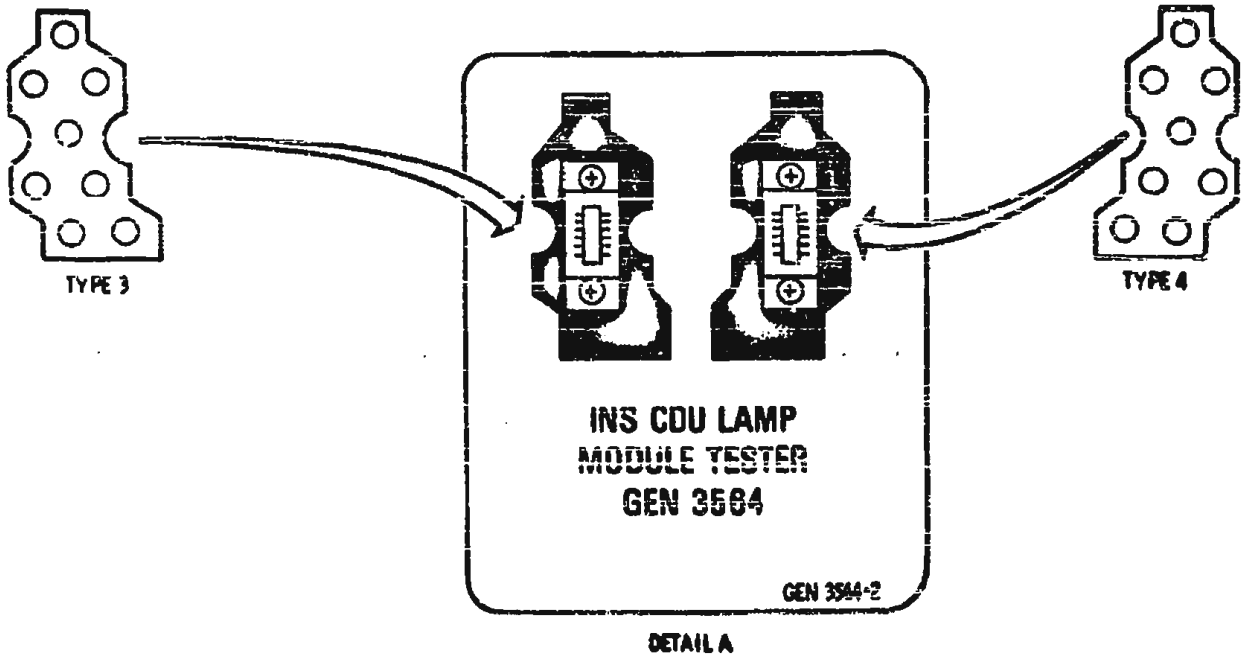
CR Control/Display Unit (P/N 7891390) - Relamping Disassembly
CR Figure 305 (Sheet 2)

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
002B

C
C lamps and ship to MCI on a M220 salvage tag for relamping.



GEN 3564 - INS CDU LAMP MODULE TESTER



DETAIL A

M1-0000-34-3635

C
C INS CDU Lamp Module Block Lamp Testing
Figure 306

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
002B

C INS CONTROL/DISPLAY UNIT - REMOVAL/INSTALLATION

C 1. General

C A. The INS control/display units (CDU) are located on the C flight deck in the forward control stand electronic panels. C Each unit is held in place by four quick-release fasteners C and has two electrical cables attached to the rear panel C through two connectors.

C NOTE: The CDU individual lamps, displays and illuminated C panel may be replaced while INS is operating, without C affecting system operation. Use 34-43-02 Servicing C (Relamping).

C 2. Remove CDU

C A. If CDU No. 1 or No. 2 are being removed, both CDU's must be C temporarily removed from console. Before moving spoiler C handle check that hydraulic systems are depressurized (Ref. C 29-00-00, Maintenance Practices).

C B. On appropriate MSU on pilots' overhead panel, set mode C selector switch to OFF position.

C C. Rotate CTR CONSOLE LIGHTS lightplate dimmer to OFF (located C at center of control stand).

C D. Loosen four quick-release fasteners.

C E. Carefully pull CDU from panel.

C F. Remove the two electrical connectors attached to the rear of C CDU.

C 3. Install CDU

C A. Connect two electrical connectors to the rear of CDU.

C CAUTION: TAKE CARE NOT TO CROSS-CONNECT CDU CONNECTORS NO. 1 OR C NO. 2 CONNECTORS BY CHECKING IDENTIFICATION ON C CONNECTORS.

C B. Ensure that CDU is right way up and place in position.

C C. Secure with the four quick-release fasteners.

C D. After installation, test by performing INS control/display
C unit adjustment/test (Ref. 34-43-02 Page 501).

C INS CONTROL/DISPLAY UNIT - ADJUSTMENT TEST

C 1. INS Control/Display Unit Test

C A. General

C (1) The INS control/display units (C/DU) are located on the
C flight deck in the forward control stand electronic
C panels. This test provides a rapid check of the
C control/display unit/navigation unit interface.

C B. Referenced Procedures

C (1) 21-25-00, Equipment Cooling - Adjustment/Test
C (Operating Test)

C (2) 24-00-00, Manual Control - Maintenance Practices (Apply
C Power)

C C. Prepare for Test

C (1) Set mode selector switch on each MSU in pilots overhead
C panel to OFF position.

C (2) Provide electrical power. Refer to 24-00-00.

C (3) Supply equipment cooling. Refer to 21-25-00.

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION
C UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE
C ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF
C NAVIGATION UNITS.

C (4) On the pilots overhead circuit breaker panel, CB1,
C verify that the listed circuit breakers are closed for
CR INS being tested:

CR INS-1

CR	VG/INS-1	(G6)	No. 1 Navigation
CR	INS PWR	(E6)	No. 1 Nav & Instr
CR	INS HTR	(E7)	No. 1 Nav & Instr

CR INS-2

CR	INS/VERT GYRO	(G24)	No. 2 Navigation
CR	INS HTR	(G25)	No. 2 Navigation

CR	INS 3		
CR	INS 3/GYRO 3	(E24)	No. 2 Nav & Instr
CR	INS 3 HTR	(E25)	No. 2 Nav & Instr

C (5) Close circuit breakers on front panel of appropriate
C INS Battery Unit.

C D. Test INS Control/Display Unit

C (1) Check Turn-On and Lamp Test (ALL INS)

C (a) Set appropriate MSU mode selector switch (pilots
C overhead panel) to ALIGN. Check that:

C 1) Red, amber, and green lamps do not illuminate.

C NOTE: Some lights, including the red WARN light
C and green READY NAV light, may flash
C briefly at turn-on.

C 2) INSERT key is illuminated on each C/DU.

C 3) Numerals 0 1 appear in FROM-TO display on each
C C/DU.

C (b) Set appropriate C/DU data selector to POS and
C press and hold TEST switch. Check that:

C 1) All keys (except keyboard and CLEAR keys) and
C lamps on C/DU and MSU illuminate.

C 2) Numerals 88°88.8 N/S are displayed in
C left-hand C/DU data display.

C 3) Numerals 883°88.8 E/W are displayed in
C right-hand C/DU data display.

C 4) Numerals 8 8 are displayed in C/DU FROM-TO
C display.

C E. Restore Airplane to Normal

C (1) Set each INS mode selector switch to OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE
C INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND
C DEPLETE BATTERY.

C (2) Remove electrical power if no longer required. (3)
C Remove equipment cooling if no longer required. Refer
C to 21-25-00.

C INERTIAL NAVIGATION UNIT - AIR FILTER MAINTENANCE PRACTICES

C 1. General

C A. Sufficient contaminates and dirt enters the INS navigation
C unit to overload the internal filters and retard the flow of
C air. This reduces equipment cooling efficiency and
C ultimately results in increased equipment failure rates. An
C air filter has been attached to the top of navigation unit
C to reduce airflow degradation due to airborne contaminates.

C 2. Navigation Unit Air Filter Cleaning

C A. Equipment Required

C (1) Mild detergent soap (All or equivalent).

C B. Cleaning Filter

C (1) Remove filter from the top of the navigation unit by
C loosening the two clamping screws until assembly slips
C off the unit. (Ref. Fig. 201.)

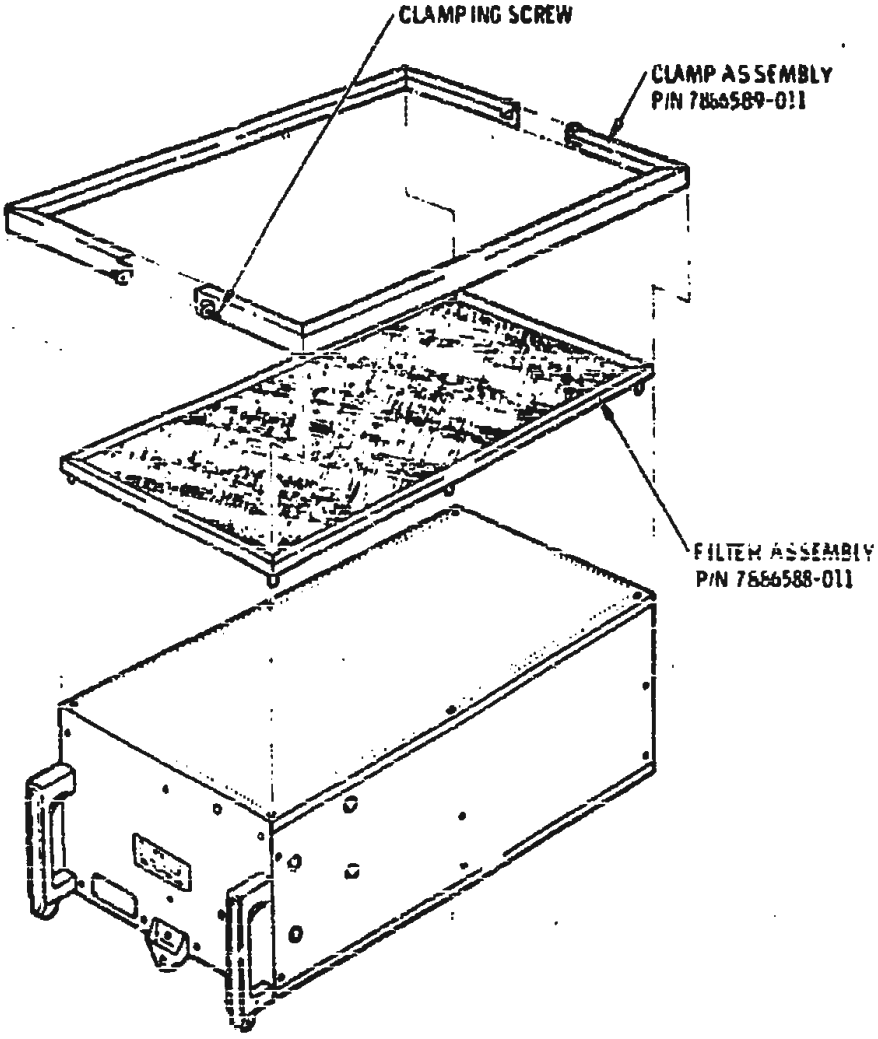
C (2) Clean filter assembly by immersing up and down in mild
C detergent solution and water. Rinse with clear water.
C If desired, filter may be vacuumed prior to washing.

C (3) Install clean filter on navigation unit.

C (a) Place air filter on top of Navigation Unit with
C spacer legs down.

C (b) Slip clamp assembly over filter.

C (c) While pressing down on clamp assembly to ensure
C firm seating of filter and clamps, alternately
C tighten the two clamping screws until the filter
C assembly is tightly secured to the navigation
C unit. Do not tighten the screws beyond the point
C at which the edge of the two halves of the clamp
C assembly have butted against each other.



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C
C

Air Filter Installation
Figure 201

C

INS NAVIGATION UNIT - REMOVAL/INSTALLATION

C 1. General (Fig. 401)

C A. The navigation units are installed in the FESC, forward rack
C and held in place by two cam-action levers built into the
C unit handles. Each navigation unit is electrically
C connected by two connectors in the rear of the unit.

C 2. Equipment and Materials

C A. Equipment required for installation only

C (1) Mechanics scale - graduated in tenths of an inch

C (2) Open-end torque wrench - range of at least 20 to 30
C pound-inches

C 3. Referenced Procedures

CR A. 34-43-03 INS Navigation Unit - Adjustment/Test

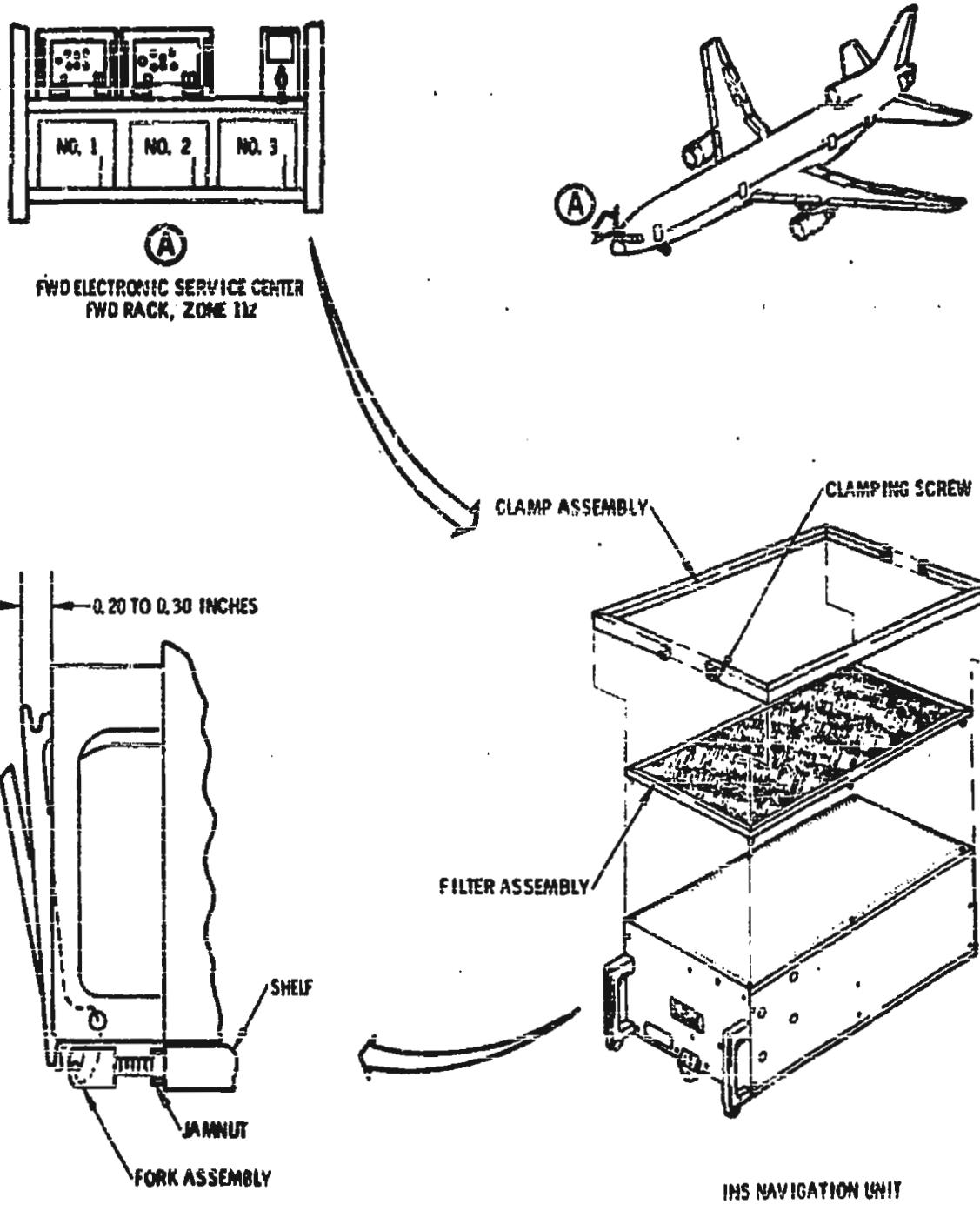
C 4. Remove INS Navigation Unit

C NOTE: An air filter is installed on top of the navigation unit.
C When unit is replaced, the filter must remain with
C removed unit.

C A. Set mode selector switch on appropriate MSU (on pilots
C overhead panel) to OFF position.

C B. Set ALT ATT source select switchlights on captains and first
C officers main instrument panel to NORM (unlatched) position.

C C. On circuit breaker panel CB1, open all INS 1, 2 or 3 circuit
C breakers depending on which INU is to be removed.



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C INS Navigation Unit - Removal/Installation
C Figure 401

INS-1	VG/INS-1	(G6)	No. 1 Navigation
	INS PWR	(E6)	No. 1 Nav & Instr
	INS HTR	(E7)	No. 1 Nav & Instr
	AREA NAV	(E8)	No. 1 Nav & Instr
INS-2	INS/VERT GYRO	(G24)	No. 2 Navigation
	INS HTR	(G25)	No. 2 Navigation
	AREA NAV	(E26)	No. 2 Navigation
INS-3	INS 3/GYRO 3	(E24)	No. 2 Nav & Instr
	INS 3 HTR	(E25)	No. 2 Nav & Instr

CR CAUTION: ALLOW 5 MINUTES FOR GYROS TO RUN DOWN BEFORE REMOVING UNIT OR GIMBAL DAMAGE MAY RESULT. USE CARE DURING REMOVAL TO PREVENT DAMAGE TO AIRFLOW SEAL. UNIT SHOULD BE TRANSPORTED IN ITS SHIPPING CONTAINER AT ALL TIMES.

D. Remove INS navigation unit.

CAUTION: TO AVOID DAMAGE TO AIR FILTERS, DO NOT STACK NAVIGATION UNITS.

NOTE: Facing forward, navigation unit No. 1 is installed on the left, No. 2 in the center, and No. 3 on the right.

5. INS Navigation Unit Shipment from International Stations

A. A mounting tray is installed for stowage of unserviceable INS Navigation Units from international stations to JFK for most expenditious shipment to MCI for repair. The mounting tray is located on LH Aft Avionics Rack Shelf 3 adjacent to the LORAN tray. It is labeled SPARE - INS NAV UNIT and consists of appropriate rear alignment pins and front camloc attachment bracketry on a tray assembly.

B. When an INS navigation unit is replaced at an international station, it can be placed in the spare INS nav unit rack with appropriate shipping and maintenance forms attached. At JFK the unit will be removed and placed in a shipping container for handling and shipment to MCI for repair.

C. After an unserviceable INS Navigation Unit is placed aboard the SPARE-INS NAV UNIT RACK, send the following teletype message to advise JFK Maintenance to remove the unit from the aircraft, place in the proper container box, and forward to Stores. This will also advise JFK Stores for most expenditious shipment of the unit to MCI.

C JFKMF CPY JFKMM JFKJJ JFKEA MCIMD MCIEC ORYMN

C RMV INS NU TWA SER NO _____ FRM PL _____ SPARE
C REPEAT

C SPARE INS RACK LH AFT AVIONICS RACK, SHELF 3 OFF FLT
C (NUMBER)-(DATE) UR

C STA. PLACE IN REUSABLE CONTAINER BOX 80 AT AIRCRAFT

C ROUTE TO STORES. SHIP AOG TO MCI.

C D. The various provisioning and stores functions must be
C accomplished in a similar manner to currently used
C procedures. Refer to the Parts & Material Handling Manual
C for current procedure.

C CAUTION: EXERCISE EXTREME CAUTION - WHEN HANDLING INS
C NAVIGATION UNIT TO PREVENT DAMAGE.

C E. The following is quoted from the Parts & Material Handling
C Manual for emphasis of careful handling required:

C Gyro Instrument

C All gyro-type units are to be issued or
C transported to aircraft for installation only when
C fully packaged in their approved boxes. The
C following instrumentation units containing gyros
C must be transported, shipped, stored, and moved to
C installation area within the assigned reusable
C container.

C 58200 Computer INS Box 80

C 6. Reusable Container Box No. 80 Handling

C A. After placing the unserviceable INS Navigation Unit aboard
C the SPARE-INS NAV UNIT rack, ship the empty reusable
C container box No. 80 per Parts & Material Handling Manual
C procedures to JFK Stores for use in shipping units to MCI.
C Several additional container box No. 80 are provided at JFK
C Stores for use on a rotation basis.

C 7. Install INS Navigation Unit (Fig. 401)

CR A. Slide navigation unit onto shelf. Engage camlock handles in
C shelf fork assemblies and actuate to fully seat connectors
C at rear of unit.

C CAUTION: CARE IS REQUIRED TO PREVENT TEARING OF AIRFLOW SEAL.

CR B. When connectors are fully seated, a noticeable increase in
C pressure is felt in locking levers. At this point, thread
C fork assembly in or out until locking levers are 0.20 to
C 0.30 inch from locked position (Fig. 401).

C CAUTION: IMPROPER ADJUSTMENT OF CAM-LOCK LEVER LATCH FORK
C ASSEMBLIES ON EQUIPMENT SHELF MAY CAUSE SYSTEM
C MALFUNCTION OR EQUIPMENT DAMAGE.

CR C. Tighten jamnuts on fork assemblies to 20-25 pound-inches.

CR D. Seat locking levers into handles.

CR E. Close circuit breakers opened in removal procedure.

C 8. Perform INS Navigation Unit Test

C A. After installation perform the INS operational test (Refer
C to 34-43-00 Adjustment/Test). Alignment will require
C approximately 20 minutes to reach NAV READY.

C 9. Pooled or Borrowed INS Navigation Units

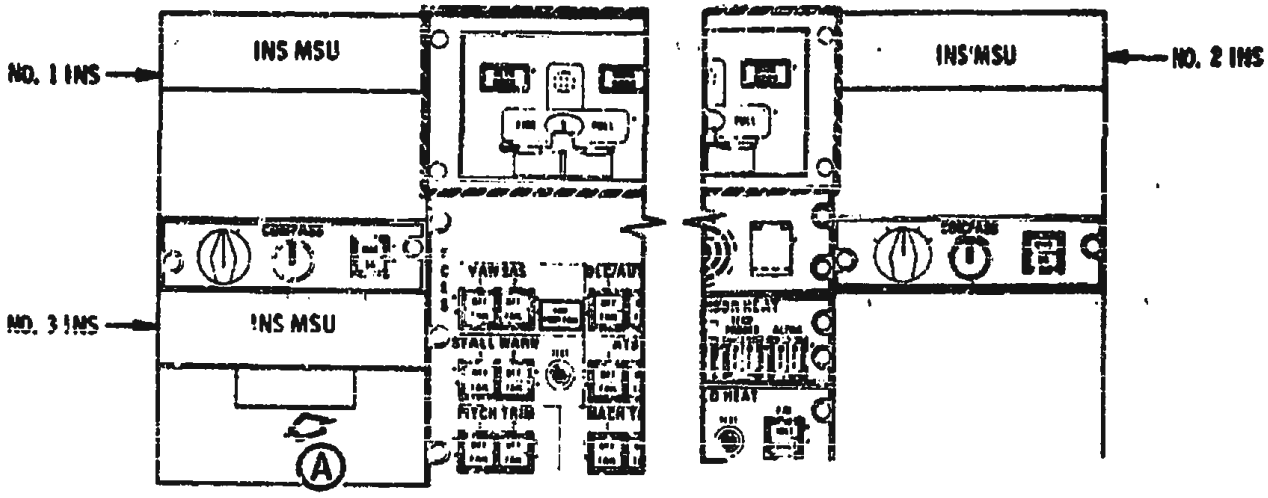
C A. The INS Navigation Units borrowed from another airline for
C pooling benefits do not have the program revision
C incorporated by TWA. As a result, the READY NAV light will
C not be lighted during NAV mode and desired performance index
C may be "4" rather than always "5" at INS turn-on. B.
C Borrowed unit will be installed in Nbr. 3 position.

C To assure that the flight crews are properly notified of a
C borrowed navigation unit being installed, fill out a TWA
C Stk. Nbr. 46-1333 Placard and place near Nbr. 3 INS Mode
C Selector Unit (MSU) as in Figure 402. It should be
C remembered that INS No. 3 MSU is located between the No. 1
C and No. 2 MSU. Follow the procedure indicated in the GP&P
C Manual, Section 8-30-1, for filing on the log book cover.

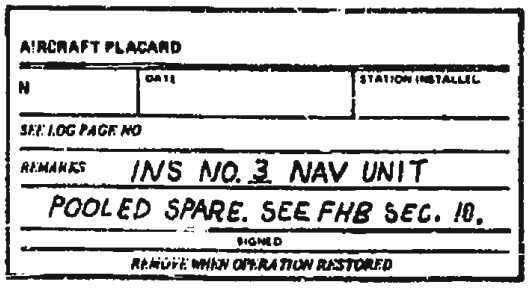
C NOTE: Cross out the word "INOPERATIVE" and write in "INS 3
C POOLED SPARE". Remove this portion of the placard
C and place on P5 overhead panel as shown below.

10. Sigmadata Reporting

A. To allow easier completion of the TWA Form M-215 after removal of an INS Navigation Unit, and provide the pertinent malfunction information to the MCI shop mechanic (as well as



BORROWED INS UNIT - PLACARD INSTALLATION
FIGURE 402 (SHEET 1 OF 2)



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BORROWED INS UNIT - PLACARD INSTALLATION
FIGURE 402 (SHEET 2 OF 2)

M1-0002-34-3625

providing a guide for aircraft troubleshooting), the Significant Maintenance Data (SIGMADATA) format will be rubber-stamped on the back-side under "Removal Comments". Each item is significant to the MCI shop mechanic as he troubleshoots the unit. His troubleshooting can begin in the problem area rather than checking several areas for an undefined problem. This will reduce MCI shop repair time and allow quicker turnaround of units to your station. Shown in Figure 403 is the SIGMADATA format that will appear on the M-215 tag attached to the INS Navigation Unit (R&R 58200):

B. The following is a description of each item of the SIGMADATA format:

(1) CDU WARN LAMP: GND _____ FLT _____. Check (X) GND if the CDU WARN lamp came on during ground operation. Check FLT if the WARN lamp came on during flight as reported by the flight crew.

(2) ACTION/MALF CODES _____. Record the action (01 thru 05) and malfunction codes (10 thru 63) that appear on the INS control/display unit when DSRTK/STS is selected. When an action code appears, press the TEST button and record each malfunction code that appears

INS NAVIGATION UNIT (R&R 58200):

REMOVAL COMMENTS

SIGMA DATA

CDU WARN LAMP: GND___ FLT___

ACTION/MALF

CODES

_____

FLAGS: NAV___ HDG___ ATT___

FINC___ AUTO SHUTDOWN___

_____

ACCURACY SQUAWK: YES___ NO___

OTHER:

M1-0000-34-3606

M-215 - Sigmadata Format
Figure 403

C C until the digits go blank or the action code reappears. Perform this readout in STBY mode only.

C C C (3) FLAGS: NAV _____ HDG _____ ATT _____. Check (X) the flag that has appeared in the HSI (NAV or HDG) or the ADI (ATT).

CR CR CR CR CR CR (4) COMPARATOR_____. Check (X) this block when the INS-1, INS-2 or INS-3 COMPARATOR lamp lights on the captain or first officers instrument panels. These (Intersystem Comparison) lamps light only when the RAD/INS switch is positioned to INS and the INS intersystem distance comparison criteria has been exceeded.

R (5) AUTOSHUTDOWN _____. Check (X) this block when the INS automatically shuts down during alignment on the ground.

R (6) ACCURACY SQUAWK: YES _____ NO _____. Check (X) the YES block when INS navigation accuracy was written up in the aircraft log. Check NO when navigation accuracy was not written up.

R (7) OTHER: Record all other malfunction indications that were determined during troubleshooting or from the aircraft log.

C. The importance of properly checking for these SIGMADATA items during aircraft troubleshooting cannot be over-emphasized. Removing an INS navigation unit from the aircraft before performing these checks will in most cases result in a non-verified failure in the MCI shop. Each Avionics or Electronic Foreman should assure that all mechanics servicing the INS carry a check list of these items to assure that the SIGMADATA can be accurately completed on the M-215 form.

D. Flight crews are also being advised to record the SIGMADATA information on the aircraft log for use by Maintenance personnel.

C INERTIAL NAVIGATION SYSTEM BATTERY CHARGER - ADJUSTMENT/TEST

C 1. General

C A. The battery charger provides a two ampere constant current
C charge for the battery unit. The battery charger operates
C only when the battery unit potential drops to 26.5 V DC or
C below, providing the battery unit power is not being used.
C The battery charging stops automatically when the battery
C unit potential reaches 29.5 V DC.

C B. Referenced Procedures

C (1) 21-25-00, Equipment Cooling - Adjustment/Test
C (Operational Test)

C (2) 24-00-00, Electrical Power - Maintenance Practices
C (Apply Power)

C 2. Equipment and Materials

C A. Simpson 260 Voltmeter or Equivalent

C B. Test leads with insulated alligator clips

C 3. Adjustment/Test

C A. Connect power to the aircraft and energize circuits for
C normal INS operation. Supply equipment cooling. Refer to
C 21-25-00.

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION
C UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE
C ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF
C NAVIGATION UNITS.

C B. Ensure that the INS mode selector switch is OFF.

C C. Lift the battery cover and prop open.

C D. Attach DC voltmeter leads with insulated alligator clips to
C the positive terminal of first cell and the negative
C terminal of last cell.

C CAUTION: TAKE EXTRA CARE THAT THE METER LEADS DO NOT SHORT THE
C BATTERY AS DAMAGE TO THE INS BATTERY CHARGER WILL
C RESULT. IF THE INS BATTERY CHARGER IS DAMAGED THE INS
C NAVIGATION UNIT WILL HAVE TO BE REPLACED.

C E. Record voltage. Reading should be approximately 24 V DC.

C F. Turn the INS mode selector switch to STANDBY. Determine
C that the INS has gone to the standby mode by observing the
C CDU and noting that one or more displays have lamp segments
C illuminated.

C G. A voltage that is at least 2.0 V DC higher than the voltage
C recorded in Step 3.E. should exist at some time during the
C first 5 minutes of operation. This higher voltage will
C fluctuate between the Step 3.E. voltage and the higher
C voltage for at least one 10 second period or will remain at
C the higher voltage for at least one ten second period.

C H. When the 10 second requirement shown in Step 3.G. is met the
C charger is operational.

C I. Turn the INS mode selector to OFF.

C J. Remove the voltmeter leads from battery unit and close the
C cover.

C NOTE: 1. If the battery voltage is above 26.0 V DC, the
C battery does not need a charge and the charger may
C not come on.

C 2. If the battery voltage is below 21.0 volts DC the
C INS may not turn on.

C 3. If 115 V AC INS power is not available the INS
C will not turn on.

C K. If no longer required, remove equipment cooling, Refer to
C 21-25-00.

C L. If no longer required, remove airplane power. Refer to
C 24-00-00.

C INERTIAL NAVIGATION UNIT - INSPECTION/CHECK

C 1. General

C A. The volume of airflow through the navigation unit will be
C checked at times called out on work cards and corrected as
C necessary when airflow is low.

C 2. Airflow Check of INS Unit

C A. Refer to Figure 601.

C B. Equipment and Materials

C (1) Airflow Tester, EQ-1132(R&R 90199)

C C. Remove INS power to the system to be checked

C (1) Place the Mode Selector Unit switch to OFF.

C (2) Set ATT ALTN switches on the captains and F/O main
C instrument panels to NORMAL (released) position.

C (3) Open all circuit breakers controlling power inputs to
C the INS unit to be airflow tested.

C INS-1

C VG/INS-1 (G6)

C INS PWR (E6)

C INS HTR (E7)

C AREA NAV (E8)

C INS-2

C INS/VERT GYRO (G24)

C INS HTR (G25)

C AREA NAV (E26)

C INS-3

C INS 3/GYRO 3 (E24)

C INS 3 HTR (E25)

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
001B

(4) In the forward electronic service center (FESC), verify that the circuit breaker on the respective INS Battery is open.

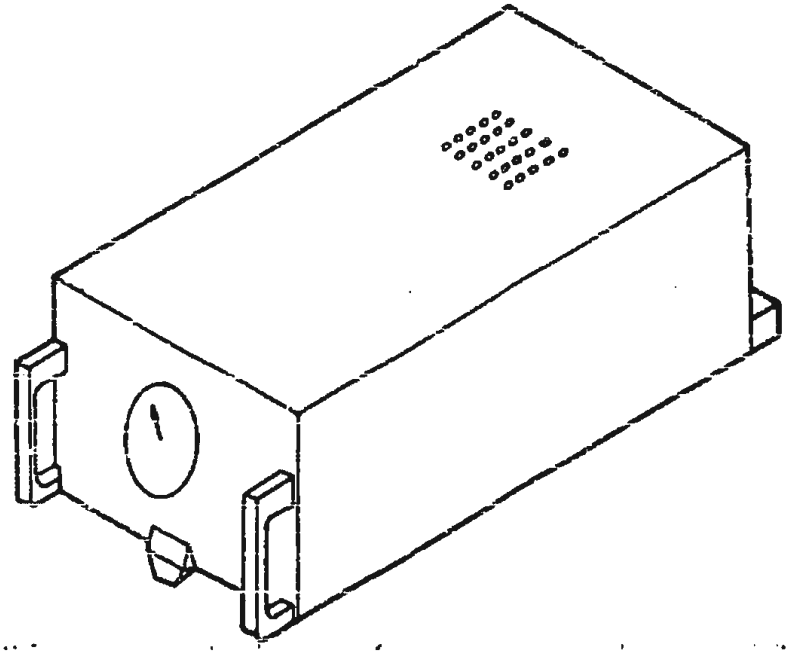
D. Airflow Check

(1) Remove the INS navigation unit for the system to be tested.

CAUTION: ALLOW 2 MINUTES AFTER THE SYSTEM IS TURNED OFF BEFORE REMOVING THE INS NAVIGATION UNIT. THIS WILL PRECLUDE GIMBAL AND GYRO DAMAGE. USE CARE IN REMOVING THE UNIT TO PREVENT DAMAGE TO THE AIRFLOW SEAL.

(2) Install the airflow tester in the navigation unit rack.

(3) Check for proper FESC equipment cooling fan operation by verifying that FESC exhaust fan is operating and exhaust control valve is open (Ref. 21-25-00). To verify, check for fan-driven exhaust air flow from the approximately 6 by 8-inch oval opening in the lower right forward fuselage, below the flight station windows.



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INS Airflow Tester - EQ 1132
Figure 601

C (4) On Flight Engineer (Second Officers) ECS MONITOR panel, C zone 215, verify the following:

C (a) AVIONIC AIR-FWD indicator light: OVBD legend C illuminated, LO FLO legend extinguished.

C CAUTION: WHEN AVIONIC AIR-FWD INDICATOR LO FLO IS C ILLUMINATED, THE INS MAY NOT HAVE SUFFICIENT C COOLING AIR. IN SUCH AN EVENT, THE INS C COOLING ON LEGEND SHOULD BE ILLUMINATED. DO C NOT OPERATE INS WHEN AVIONIC AIR-FWD C INDICATOR LO FLO IS ILLUMINATED TO PREVENT C INS NAVIGATION UNIT DAMAGE.

C (b) INS COOLING switchlight: ON legend extinguished, C LO FLO legend extinguished.

C (5) Observe the meter reading on the front of the airflow CR tester. Minimum acceptable airflow is 1.10 inches of CR water (3.6 lbs/min).

C (6) If airflow is below minimum requirements, correct by C performing one or all of the following:

C (a) Clean mounting rack, plenum, metering (air) tray, C airflow seal and ducts.

C (b) Replace the plenum airflow seal.

C (c) Replace the FECS avionics fan.

C (d) Clean the INS fan check valve (Ref. 21-25-16). C Reinstall the airflow tester and check airflow as C in (5) above.

CR (7) Open the GROUND SERVICE MLG GND SENSE (L8) circuit CR breaker located on the FE/SO OVHD CB PNL 2 (P9).

CR (8) Observe the meter reading on the front of the airflow CR tester. Minimum acceptable airflow is 1.10 inches of CR water (3.6 lbs/min).

CR (9) If airflow is below minimum requirements, perform the CR following:

CR (a) On airplanes effectivity 019, 020, 023-031: Close CR off the INS cooling fan exaust duct aft of the INS CR check valve where it dumps air into the FESC and CR check the airflow as in Step (8) above. If this CR corrects the low airflow, replace the INS check CR valve and check the airflow as in Step (8) above.

CR (b) On all INS equipped airplanes: Check the ducts
CR between the FESC cooling fan and forward avionics
CR rack for leaks or blockage.

CR (10) Close the GROUND SERVICE MLG GND SENSE (L8) circuit
CR breaker located on the FE/SO OVHD CB PNL 2 (P9).

CR (11) Remove the airflow tester.

CR (12) Reinstall the INS navigation unit.

CR (13) Activate all circuit breakers pulled for the unit
CR removal, and perform an operational check per
CR maintenance manual 34-43-00, Page 501.

R # INERTIAL NAVIGATION SYSTEM BATTERY UNIT - SERVICING

R 1. General

R A. The servicing to be performed on the INS battery unit
R consists of cleaning and checking the electrolyte level.

R 2. Equipment and Materials

R A. Distilled or demineralized water.

R B. A syringe with a small nozzle.

R C. A polystyrene tube, open on both ends, approximately 1/8
R inch inside diameter about six inches long.

R D. Clean cloth and non-metallic brush.

R CAUTION: TOOLS OR EQUIPMENT USED FOR SERVICING OF LEAD-ACID
R BATTERIES MUST NOT BE USED FOR SERVICING
R NICKEL-CADMIUM BATTERIES.

R 3. Servicing Battery

R WARNING: THE BATTERY ELECTROLYTE IS CAUSTIC POTASSIUM HYDROXIDE
R AND WILL BURN THE SKIN AND CLOTHING. IF SPILLED,
R NEUTRALIZE WITH VINEGAR OR MILD BORIC ACID SOLUTION.
R IF THESE ITEMS ARE NOT AVAILABLE, WASH THOROUGHLY WITH
R WATER. IMMEDIATE MEDICAL ATTENTION IS REQUIRED IF
R ELECTROLYTE HAS CONTACTED THE EYES.

R CAUTION: DO NOT SPILL WATER OR ELECTROLYTE INTO BATTERY
R CONTAINER. RESULTANT ELECTROLYTE CORROSION MAY CAUSE
R DAMAGE.

R A. The battery units are mounted on the FESC rack (between
R forward and center racks) on the left hand side.

R B. Open the circuit breaker on the front of the battery unit.
R The battery unit may be taken to the battery service area if
R desired.

R C. Lift the battery cover and prop open.

R D. Check for evidence of excess spewage, loose terminal
R connections, burning or discoloration of terminal
R connections. If condition exists replace battery.

R NOTE: A battery which has spewed electrolyte excessively
R will usually display large crystalline deposits on
R the tops of the cells. A battery in this condition
R has been subjected to high charger voltages, high
R ambient temperatures during charging or the liquid
R level may have been improperly serviced.

R E. Clean the battery unit with a non-metallic brush and
R cleaning cloth.

R F. Remove the filler cap vent plug from one cell.

R G. Check and if necessary adjust electrolyte level to 1/8 inch
R above bottom of baffle.

R NOTE: Check the electrolyte level by inserting the
R polystyrene tube into the filler opening deep enough
R to touch the top of the plates or plastic insert.
R Grasp the tube between thumb and middle finger, place
R index finger over the top open end of the tube and
R remove the tube from the filler well. The level in
R the lower end of the tube will be the level of the
R electrolyte in the battery.

R H. Install the filler cap vent plug.

R I. Repeat Steps 3.F., 3.G., and 3.H., for each cell of battery.

R J. Install the battery unit cover, and if battery was removed
R from the aircraft re-install battery unit in the aircraft.
R Ensure that the circuit breaker is open before installing
R the battery unit.

R K. Close the battery unit circuit breaker.

C # BATTERY UNIT - REMOVAL AND INSTALLATION

CR 1. Reference Procedure

CR 34-43-05 INS Battery Unit - Adjustment and Test

C 2. General (See Fig. 401)

C A. The INS battery units (BU) are mounted in FESC rack (between C forward and center racks) on the left side of the aircraft.

C B. Remove Battery Unit

C (1) Open the circuit breaker on the battery unit front C panel before removing the unit.

C (2) Disengage the camlock handles and pull the unit out of C the rack.

C C. Install Battery Unit

C (1) Assure that the circuit breaker on the battery unit C front panel is open before installing the unit.

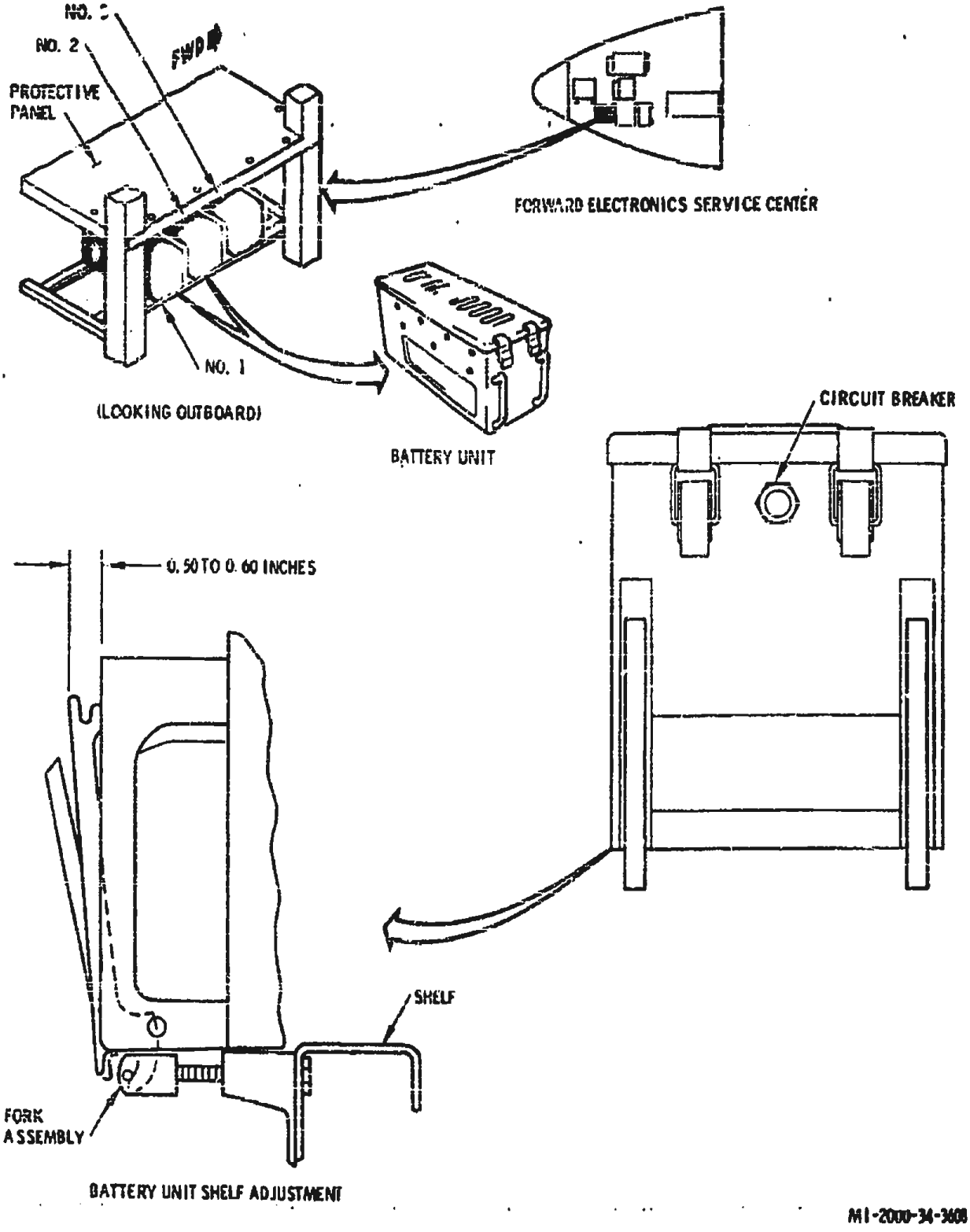
C (2) Slide the unit onto the equipment shelf, engage the C camlock handles in the shell fork assemblies and use C the camlock action to fully engage the unit with the C rack.

C (3) When the connector is fully seated, a noticeable C increase in pressure is felt in the locking levers. At C this point, thread the fork assembly in or out until CR the locking levers are 0.50 to 0.60 inch from locked C position. (See Fig. 401).

C (4) Seat the locking levers into the handle.

C (5) Close the Battery Unit front panel circuit breaker.

C (6) Conduct a test of the affected battery unit (Refer to C 34-43-05, INS Battery Unit - Adjustment/Test.)



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C
C

Battery Unit - Removal and Installation
Figure 401

EFFECTIVITY: INS EQUIPPED AIRCRAFT

003B

C INS BATTERY UNIT - ADJUSTMENT/TEST

C 1. INS Battery Unit Test

C A. General

C (1) This test of the INS battery unit verifies proper battery installation, and tests the battery unit under full load conditions.

CR (2) Observe The following safety requirements when working around INS batteries:

CR Wear eye protection when servicing batteries.

CR Do not use open flame in the vicinity of batteries.

CR Do not wear metallic finger rings when working on batteries.

CR Do not work on nickel-cadmium batteries with acid contaminated water or tools, hydrometers and other instruments that have been used on lead-acid batteries.

CR Provide adequate ventilation.

CR Wear safety mask or goggles.

C B. Referenced Procedures

C (1) 21-25-00, Equipment Cooling Adjustment/Test (Operational Test)

C (2) 24-00-00, Maintenance Practices (Apply Power)

C C. Prepare for Test

CR WARNING: BE CAREFUL WHEN WORKING WITH TOOLS AROUND THE BATTERY TERMINALS. THESE UNITS CAN DELIVER VERY HIGH CURRENTS WHEN SHORTED, AND EVOLVED GASES MAY BE EXPLODED BY A SPARK. IT IS ADVISABLE TO REMOVE FINGER RINGS WHEN WORKING ON BATTERIES SINCE A RING MAY FUSE TO THE INTERCELL STRAPS AND CAUSE THE LOSS OF A FINGER.

CR WARNING: ELECTROLYTE (POTASSIUM HYDROXIDE) IS VERY CAUSTIC AND WILL BURN THE EYES, SKIN, FABRIC, ETC. IF BODY CONTACT IS MADE, NEUTRALIZE AFFECTED AREA WITH 3% BORIC ACID, WASH WITH WATER, AND REPORT TO MEDICAL FACILITY IMMEDIATELY.

CR CR CR CR **WARNING:** CHECK VENT VALVE FOR POSSIBLE SALT BUILD-UP FROM ELECTROLYTE. IF SALT IS PRESENT, REMOVE VENT VALVE AND CLEAN AND ACTUATE IT TO FREE POSSIBLE SEIZED VALVE BEFORE REINSTALLATION.

C C (1) Set each INS mode selector switch (pilots overhead panel) to OFF position.

C (2) Provide electrical power (Ref. 24-00-00).

C (3) Provide cooling air to INS equipment (Ref. 21-25-00).

CR C C C **CAUTION:** ENSURE COOLING AIR IS AVAILABLE TO NAVIGATION UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF NAVIGATION UNITS.

CR CR (4) On overhead circuit breaker panel CB1, close INS circuit breakers for appropriate INS system.

CR C (5) Ensure circuit breaker on front of battery unit is closed.

C D. Test INS Battery Unit

CR **CAUTION:** NEVER USE A WIRE (METALLIC) BRUSH.

C (1) Verify proper INS battery installation.

CR CR **NOTE:** BEFORE TESTING BATTERY, ASCERTAIN THAT TOPS OF CELLS AND SOCKET ON BACK OF INS RACK ARE CLEAN.

CR CR CR IF WHITE DEPOSITS (POTASSIUM CARBONATE) ARE VISIBLE, THESE DEPOSITS MUST BE REMOVED BY WASHING OR BRUSHING WITH A STIFF BRISTLE BRUSH.

CR CR **NOTE:** INS cannot be turned on unless battery unit is properly installed.

CR CR (a) Set appropriate INS mode selector switch on pilots overhead panel to STDBY. Check that:

CR (1) Red, amber, and green lamps do not come on.

C C C **NOTE:** Some lights, including the red WARN light and green READY NAV light, may flash briefly at turn-on.

C 2) CDU INSERT key is illuminated.

C 3) CDU FROM-TO display indicates 01.

C (2) Test INS battery under full load conditions.

CR (a) On overhead circuit breaker panel CB1, open INS
CR PWR (10A) circuit breaker for appropriate INS
CR system.

CR (b) Check that BAT light on CDU comes on.

CR (c) Wait 10 seconds. Verify WARN light on CDU does
CR not come on.

CR (d) Close INS power circuit breaker opened in Step
CR 1D(2)(a).

C E. Restore Airplane to normal

C (1) Set each INS mode selector switch to OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE
CR INS TO AUTOMATICALLY SWITCH TO BATTERY POWERWHEN
CR POWER IS REMOVED FROM AIRCRAFTAND DEPLETE BATTERY.

C (2) Remove electrical power if no longer required (Ref.
C 24-00-00)

C (3) Remove equipment cooling if no longer required (Ref.
C 21-25-00).

C INS BATTERY UNIT - INSPECTION/CHECK

C See INS Battery Unit - Servicing 34-41-05, page 301.

C INS INTERFACE UNIT - REMOVAL AND INSTALLATION

C 1. Referenced Procedure

C 34-43-00 INS - Adjustment and Test

C 2. Removal/Installation

C A. Removal

C (1) On pilots overhead circuit breaker panel CB1, zone 210, C open and tag circuit breaker NO. 1 NAV & INSTR-AREA NAV C (E8), or NO. 2 NAV & INSTR-AREA NAV (E26).

C (2) Open access door 112AB and enter forward electronics C service center, zone 113. Locate INS Interface unit to C be removed on rear rack, shelf 4 (Ref. Fig. 401).

C (3) Loosen and disengage knurled knobs securing INS C Interface unit to mount.

C (4) Grasp handle and slide navigation computer unit forward C until rear connectors disengage from mating connectors. C Remove INS Interface Unit.

C B. Installation

C (1) Verify that circuit breaker opened in Step 2A(1) is C open and tagged.

C (2) Position INS Interface unit on mount and slide into C place, aligning rear connectors and mating mount C connectors.

C (3) Place mount clamps over INS Interface unit hooks. C Tighten knurled knobs securing navigation computer C units to mount.

C (4) Close and secure access door.

C (5) Remove tag and close circuit breaker opened in Step C 2A(1).

CR (6) Perform test of interface unit as described in CR Paragraph 3 of this procedure.

CR 3. Check INS Interface Unit

CR A. Position the following switches:

CR (1) RNAV ALTN switch to normal (extinguished) position
CR (Capt 1 - F/O 2).

CR (2) RADIO/INS switch to INS (forward pedestal).

CR (3) Data selector switch to WIND (pilots control stand).

CR (4) INS Mode Selector to ALIGN.

CR NOTE: Alignment mode status must be 8 or less prior to
CR this step.

CR B. Press and hold TEST switch on control/display unit. Observe
CR the following indications on appropriate HSI.

CR (1) HDG flag and NAV annunciator are out of view.

CR (2) Digital data DISTANCE, GND SPD, and TIME show 8's.

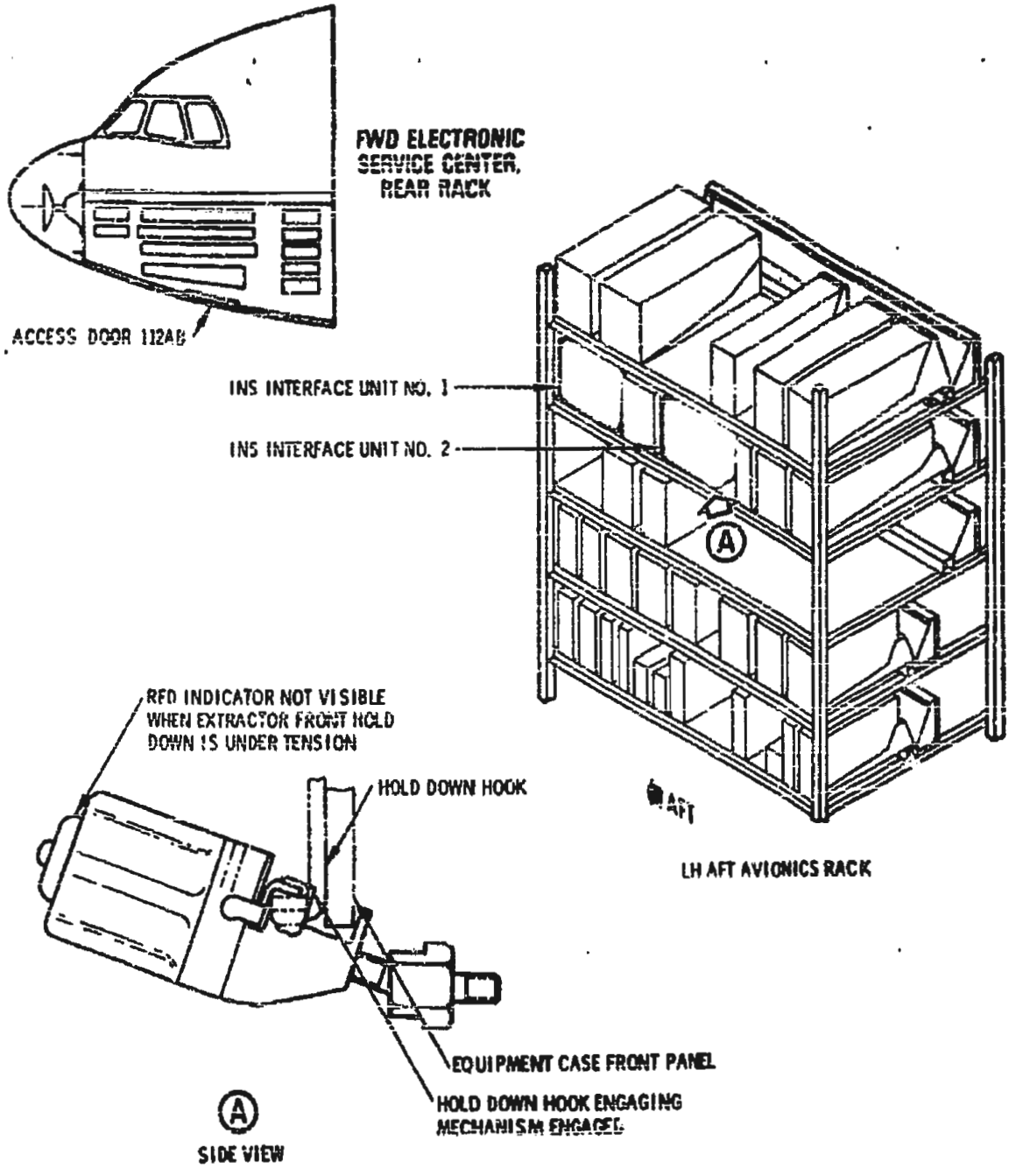
CR (3) ALERT annunciator illuminates.

CR (4) To-From pointer indicates TO.

CR (5) INS FINC light for respective INS illuminates on
CR forward center pedestal.

CR C. Release Test Switch

CR D. Turn MSU mode selectors to OFF.


FWD ELECTRONIC SERVICE CENTER, REAR RACK
ACCESS DOOR 112AB
INS INTERFACE UNIT NO. 1
INS INTERFACE UNIT NO. 2
A
FWD
LH AFT AVIONICS RACK
RED INDICATOR NOT VISIBLE WHEN EXTRACTOR FRONT HOLD DOWN IS UNDER TENSION
HOLD DOWN HOOK
EQUIPMENT CASE FRONT PANEL
HOLD DOWN HOOK ENGAGING MECHANISM ENGAGED
A
SIDE VIEW

A1-CMD-34-3409

C C INS Interface Unit - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: INS EQUIPPED AIRCRAFT

AREA NAVIGATION SYSTEM (INS) ACCESSORY UNIT REMOVAL AND INSTALLATION

1. Referenced Procedures

34-00-01 Instrument Source Select Panel - Adjustment and Test

34-22-00 Magnetic Heading Reference System - Adjustment and Test

34-43-00 Inertial Navigation System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots' overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAV & INSTR ALT SOURCE SEL CAPTS INSTR (E1), NO. 1 NAV & INSTR ALT SOURCE SEL F/O INSTR (E2), NO. 1 NAV & INSTR - AREA NAV (E8) AND NO. 2 NAV & INSTR - AREA NAV (E26).

(2) Open access door 112AB and enter forward electronics service center, zone 113. Locate area navigation system accessory unit on rear rack, shelf 4 (Ref. Fig. 401).

(3) Loosen and disengage knurled knobs securing accessory unit to mount.

(4) Slide accessory unit forward until rear connectors disengage from mating connectors. Remove accessory unit.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Position accessory unit on mount and slide into place, aligning rear connectors and mating mount connectors.

(3) Place mount clamps over accessory unit hooks. Tighten knurled knobs securing accessory unit to mount.

(4) Close and secure access door.

C (5) Remove tag and close circuit INS breakers opened in
C Step A(1).

CR 3. Perform RNAV (INS) Accessory Unit Test

CR A. Check Area Navigation System (INS) Accessory Unit.

CR (1) Check that the FESC cooling system (FWD avionics fan)
CR is operating and that the LO FLO annunciators (on the
CR ESC portion of the F/E panel) are not lighted.

CR (2) Rotate No. 1 and No. 2 INS MSU mode switches to ALIGN.
CR No. 3 INS mode switch should be OFF.

CR (3) Check that no INS WARN lights are on.

CR NOTE: If either INS warn light illuminates, select
CR DSRTK/STS on the CDU and check for action code
CR 01. If 01 appears, switch the associated mode
CR selector switch to OFF and isolate fault. See
CR L-1011 Maintenance Manual 34-43-00 Page 101.

CR (4) Set INS No. 1 and INS No. 2 CDU function switches to
CR DSRTK/STS. Wait until both INS systems display an
CR actual performance index (PI) of 8 or less.

CR NOTE: PI 8 is shown in the right CDU display as
CR XXX 8 5

CR (5) Set both INS CDU selector switches to WIND and select
CR 108.0 on both VOR frequency selectors.

CR (6) Verify that both the Capt's and F/O's RADIO/INS switch
CR have the INS legend illuminated (switch depressed).

CR (7) Verify that both the Capt's and F/O's RNAV ALTN
CR switches are in the normal position. (ALTN not
CR lighted).

CR (8) Press the Capt's RNAV ALTN switch to illuminate ALTN.

CR (9) On the Capt's HSI, note that the lower center legend
CR now displays RNAV 2.

CR (10) On the No. 1 INS CDU, press the TEST switch. Observe
CR that there is no change in the indications of either
CR HSI. Release the TEST switch.

CR (11) Press the No. 2 INS CDU TEST switch. The following
CR indications should be observed on both HSI's.

CR (a) TRUE is displayed, the NAV flag is out of view, CR and the TO pointer is visible.

CR (b) COURSE (if existing) displays 000 degrees; and the CR course deviation is approximately one dot right of CR center.

CR (c) The compass card indicates 0 degrees under the CR lubber line indice.

CR (d) DISTANCE, GND SPD and TIME digital displays all CR show 8's.

CR (e) The ALERT annunciator lights.

CR (f) The GLIDE SLOPE scale, pointer and flag are not in CR view.

CR (12) Release the No. 2 INS TEST switch and press the Capt's CR RNAV ALTN switchlight to extinguish the ALTN legend. CR The Capt's HSI now displays RNAV 1 in the lower center CR windows.

CR (13) Press the No. 1 INS CDU TEST switch. The Capt's HSI CR ONLY should indicate as in Step (11). Release the TEST CR switch.

CR (14) Press the F/O RNAV ALTN switchlight to illuminate ALTN. CR RNAV 1 is displayed.

CR (15) Press the No. 2 INS TEST switch. There should be no CR response on either HSI.

CR (16) Press the No. 1 INS TEST switch. Both HSI's should CR indicate as in Step (11). Release the TEST switch.

CR (17) Press the F/O RNAV ALTN to extinguish the ALTN legend. CR RNAV 2 is displayed.

CR (18) Press the Capt's and F/O's RADIO/INS switchlights to CR indicate RADIO.

CR (19) Check both HSI's for the following display:

CR (a) VOR 1 is displayed on the Capt's HSI, and VOR 2 is CR displayed on the F/O HSI.

CR (b) DISTANCE and TIME are all 9's, and GND SPD shows CR 0's.

CR (c) The GLIDE SLOPE scale, flag and pointer are out of CR view.

CR (d) At the top center of the HSI's, MAG heading is
CR displayed, and the NAV flag may be in or out of
CR view.

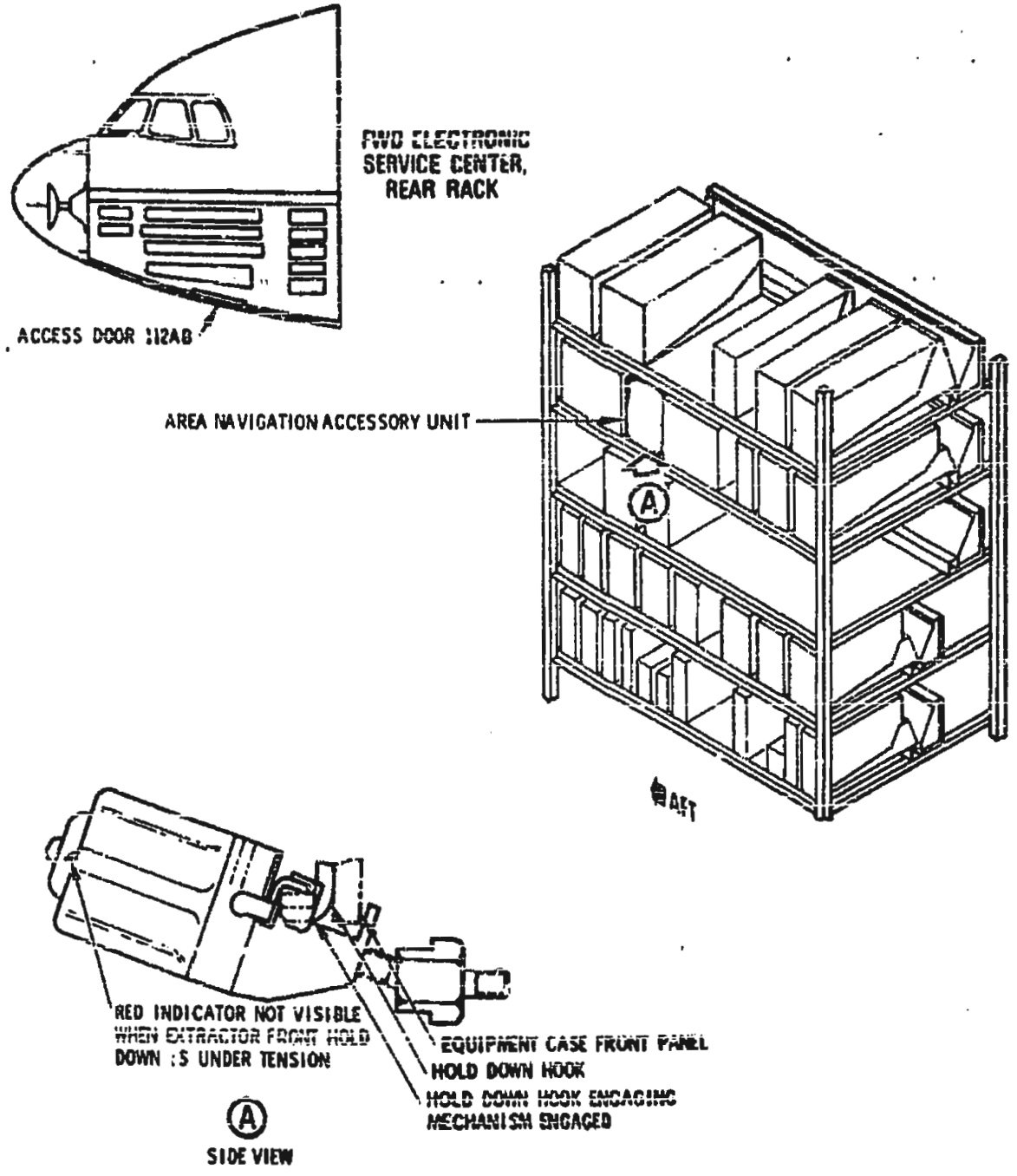
CR (e) The ALERT annunciator is not lighted.

CR (f) The COURSE digital number (if existing) and the
CR course pointer agree with the respective VOR
CR course selectors on the glareshield, and the
CR deviation bar may be in any position.

CR (g) The HEADING CURSOR agrees with the pre-set heading
CR selector on the glareshield.

CR (h) Compass cards heading indication approximately
CR agrees with the aircraft magnetic heading.

CR (20) Rotate both No. 1 and No. 2 INS MSU mode selector
CR switches to OFF.



C Area Navigation (INS) Accessory Unit - Removal and Installation
C Figure 401

R EFFECTIVITY: INS EQUIPPED AIRCRAFT
R
0016

C INS_COOLING_SYSTEM_-_MAINTENANCE_PRACTICES

C 1. INS_Cooling_System

C A. General

C (1) Maintenance Manual coverage for the INS Cooling System
C is located in Chapter 21 as indicated below:

C INS Cooling System - Exhaust Airflow Sensor
C chapter/section 21-25-15.

C INS Cooling System - Exhaust Check Valves
C chapter/section 21-25-16.

C INS Cooling System - Exhaust Fan chapter/section
C 21-25-17.

R WEATHER RADAR SYSTEM - DESCRIPTION AND OPERATION

R 1. General

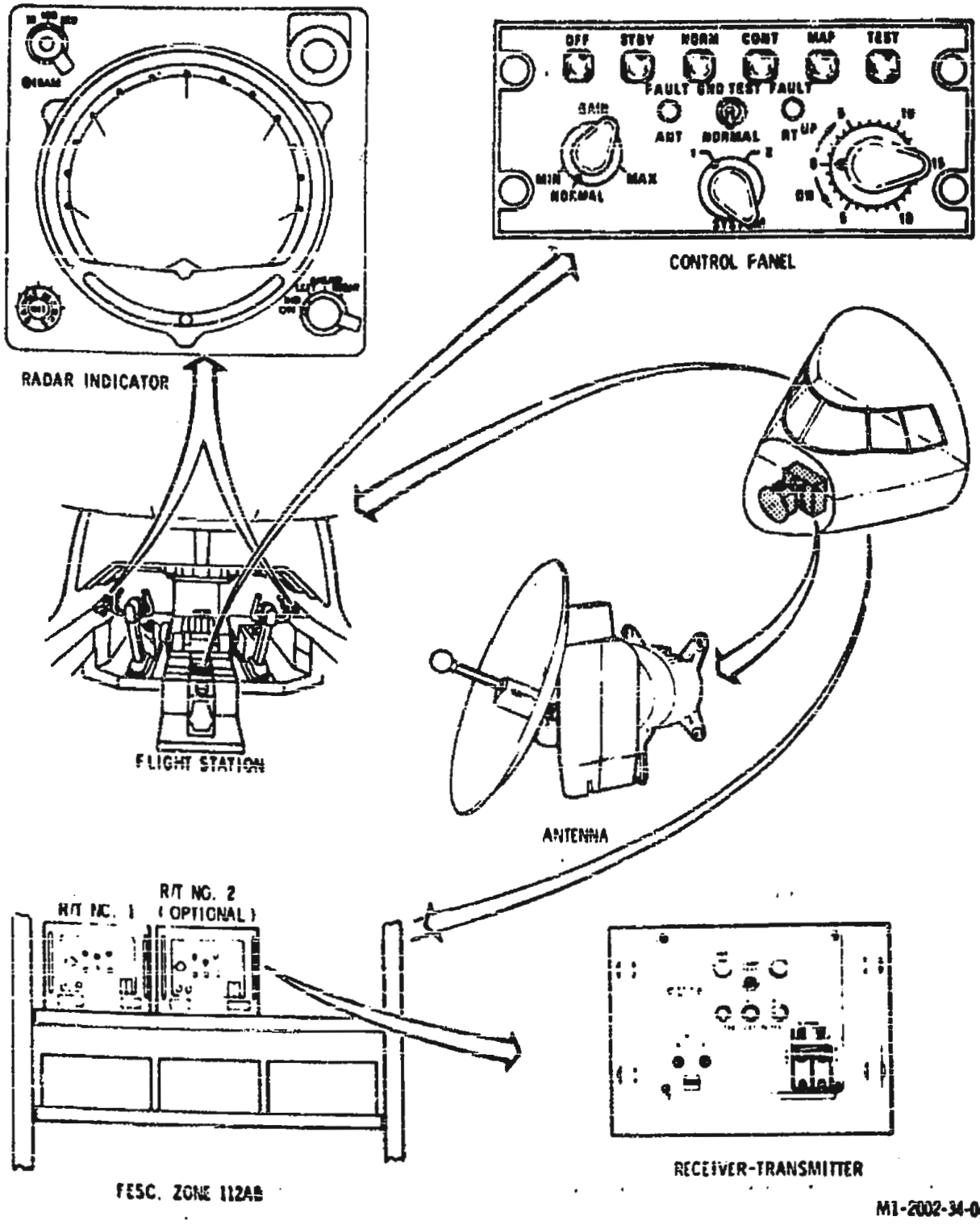
R The weather radar system (Ref. Fig. 1) is designed primarily to
R furnish continuous enroute weather information relative to cloud
R formation, rainfall rate, thunderstorms, and areas of storm
R turbulence and icing conditions; thus enabling avoidance of the
R most adverse weather conditions.

R The weather radar system is also used as a navigation aid.
R During MAP mode of operation, the weather radar system enables
R identification of terrain features such as coast lines, water
R masses and hilly or mountainous areas.

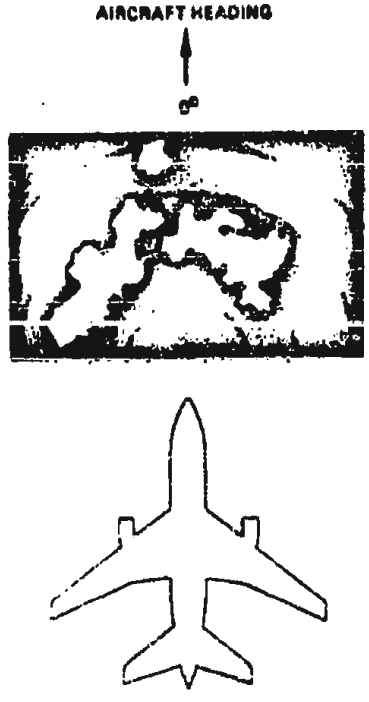
R The system operates on the radar echo principle. At a rate of
R 200 times per second, the weather radar system sends out a
R 6-millionths-of-a-second burst of electromagnetic radiation
R energy. The energy travels through space as a super
R high-frequency radio wave. When the traveling wave of energy
R strikes an appropriate target, some of the energy reflects back
R to the radar antenna and receiver. Electronic circuits measure
R the elapsed time between transmission and receipt of the echo to
R determine range of the target. Because the antenna beam is
R scanning to and fro in synchronism with the sectoring sweep on
R the indicator, the bearing of the target is found.

R The indicator is called a "PPI" type. This means plan-position
R indicator. When an architect makes a drawing for a house, one
R of the views he generally shows is a "plan" view, a diagram of
R the house as viewed from above. The plan-position indicator
R aboard the aircraft presents a cross-section picture of the
R storm as though it were viewed from above. In short, it is NOT
R a horizon view of the thunderstorm ahead; it is rather a MAP
R view. The positional relationship of aircraft and thunderstorm,
R as displayed by the indicator, is shown in Figure 2.

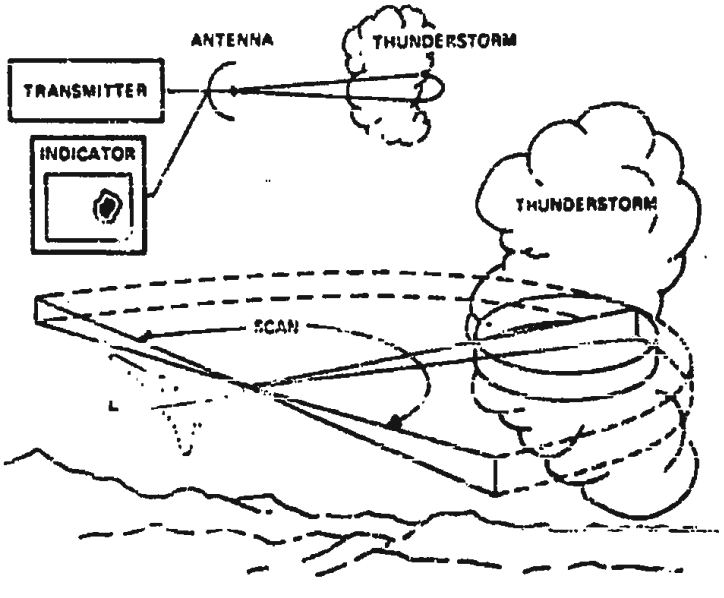
R The drawing is laid out to simulate the face of the indicator
R with semi-circular range marks. To derive a clearer concept of
R the picture the indicator presents, imagine the storm is a loaf
R of sliced bread standing on end. From a point close to the
R surface of earth, it towers to a high-altitude summit. Without
R upsetting the loaf of bread, remove a single slice from, say,
R the middle of the loaf, and place this slice flat upon the
R table. Looking at the slice of bread from directly above, is
R seen in broadest dimension, a cross section of the loaf. In the
R same manner, the radar beam literally slices out a horizontal
R cross-section of the storm, and allows it to be seen as if
R looking at it from above. The height of the slice selected for



Weather Radar System
Figure 1



POSITIONAL RELATIONSHIP OF AIRCRAFT AND
STORM CELLS AHEAD AS DISPLAYED ON INDICATOR



ANTENNA BEAM SLICING OUT CROSS-SECTION
OF STORM DURING HORIZONTAL SCAN

M1-0001-34-3635

R PPI Display
R Figure 2

R display depends upon altitude and upward or downward tilt
R adjustment made to the antenna.

R The relative brightness of rainfall indications on the display
R is representative of the rainfall concentration. The iso-echo
R contour mode of operation is provided to allow the heaviest
R rainfall concentrations to be displayed in black and are
R identifiable as black spots within the normal lighted
R indications.

R The weather radar system consists of two identical systems, one
R of which may be in use with the other system in standby mode.
R Two identical receiver/transmitters (R/T) are installed in the
R forward Electronics Service Center (FESC), zone 112, (Ref. Fig.
R 1). A waveguide switch connects the selected R/T to the antenna
R through the waveguide. The antenna has two identical drive
R systems. A single control panel controls operation of the
R weather radar, enabling R/T selection, mode selection, testing,
R receiver sensitivity adjustment (GAIN) and tilt angle selection.

R The system incorporates built in test and monitor circuitry to
R provide system performance check on the ground and in the air.

R The system provides the flight crew with a display of storm
R conditions at ranges up to 300-nautical miles. The area of
R radar surveillance is 180-degrees of azimuth (90-degrees right
R and left of aircraft heading) and 28-degrees of pitch
R (14-degrees above and below the stabilized horizontal)..

R The system operates at 9345-MHz (X-BAND), with a peak power
R output of approximately 65-KW.

R Weather radar system No. 1 receives primary power from the
R essential ac radio bus. Weather radar system No. 2 receives
R primary power from No. 2 ac radio bus. Power is applied by
R closing applicable circuit breakers on pilots overhead circuit
R breaker panel CB1, zone 210.

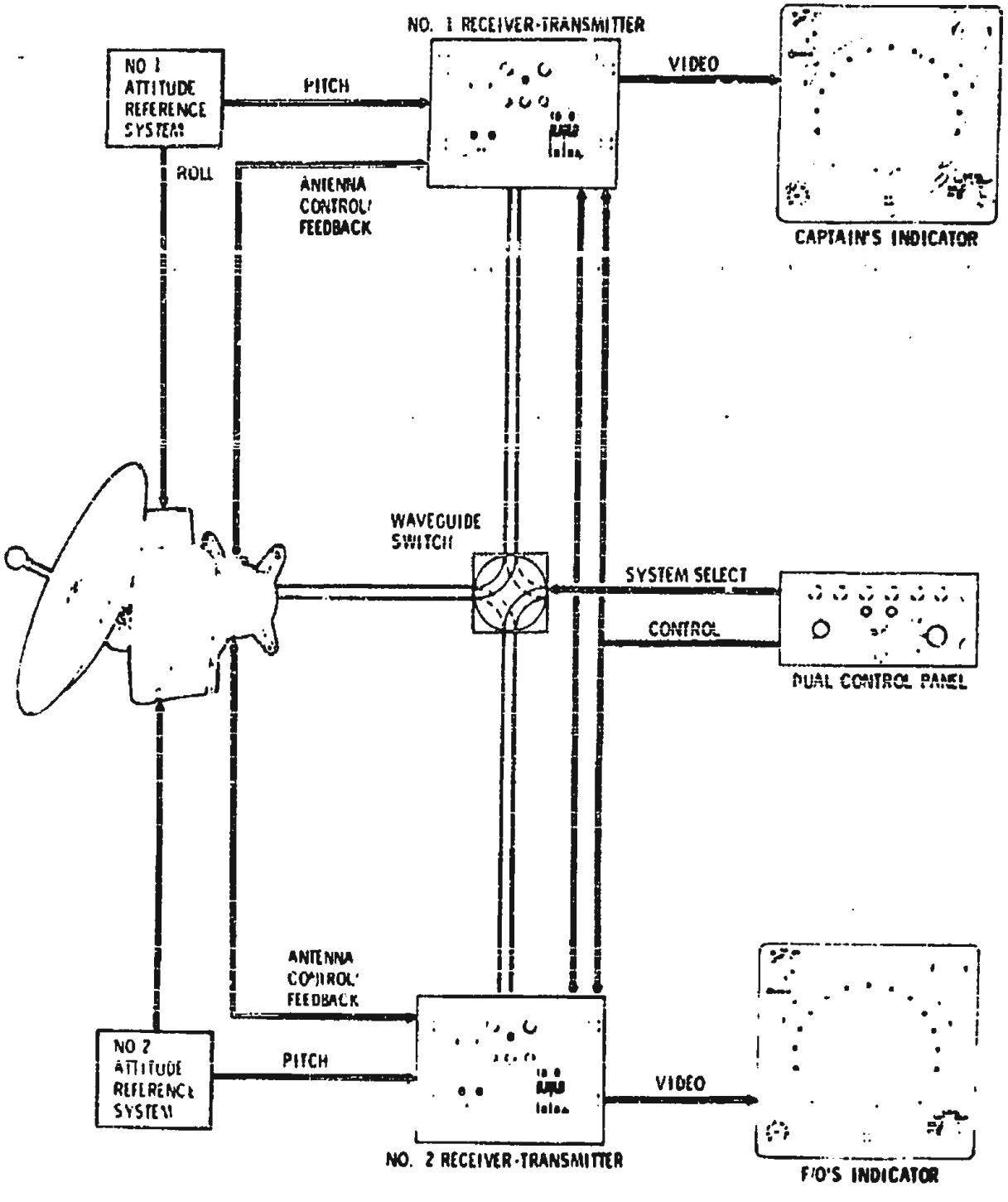
R 2. Control Panel

R The control panel is located on the center console. The panel
R contains all controls necessary for operation of system, with
R exception of indicator front panel adjustments. The panel
R controls and their function are as follows (Ref. Fig. 3):

R A. OFF

R When OFF position is selected, the system is made
R inoperative by interrupting the 28-volt supply.

R B. STBY



Weather Radar System Block Diagram
Figure 3

When STBY position is selected, filament voltage is supplied
R to the magnetron and indicator tube, and energizes the 3.5
R to 5.0-minute warm-up time delay. The indicator display is blank during standby mode.

C. NORM Mode

When NORM position is selected, the system is energized for
R weather search operation after a3.5 to 5.0-minute warmup delay. The waveguide switch connects the R/T to the waveguide and thereby terminates the rf output in the antenna.

The NORM mode of operation presents storm detected information on the indicator at ranges up to 300-nautical miles. Cloud formations having less moisture content than is required to reflect a minimum discernible echo signal will not appear on the indicator display and transit through these clouds may be effected with normal flight safety. The radar will look through such clouds to detect storm conditions beyond.

The receiver sensitivity-time control circuit functions to ensure that echo signals from similar targets are displayed with approximately equal intensity. The echo signal strength is affected, not only by target reflectivity, but additionally, by target range. Characteristically, as target range increases, echo signal strength will decrease. In order to compensate for this undesirable effect, the sensitivity-time control circuit permits receiver gain to correspondingly increase up to a range from 60- to over 100-nautical miles depending on the figure used by the airline. The results provide a realistic display intensity for targets within the sensitivity-time control circuit range.

The receiver penetration circuits provide compensation necessary to accurately display successive significant storms. When the radar detects a line of storm cells one behind another, signal strength is reduced from the further cells as the radar signal transits the intervening cells. Uncompensated, distant cells may appear smaller and less intense on the indicator than they are in actuality. The receiver penetration compensation circuitry is designed to analyze an intervening cell density and increase receiver gain proportionately. The increased receiver gain causes the signal from the more distant cell to produce a display very near to the cells true size and intensity as though no intervening cells were present.

D. CONT Mode

The contour circuitry in the receiver permits a display of rainfall gradients. The contour function is energized by selecting the CONT position. This enables the flight crew to view the actual contour of high rainfall rates surrounding the core of the thunderstorm cloud. The contour circuit function blanks all video during the period reflected signals exceed the high rainfall rate level. The contour circuit, when energized, alters normal radar presentation to display areas of high rainfall rate as black holes. The contour holes visible within the storm display, representing areas of greatest rainfall rate, are areas of greatest storm turbulence and are the least desirable flight path.

E. MAP Mode

R When MAP position is selected, the system is energized for normal weather search operation after the 3.5 to 5.0-minute warm-up delay, except as follows:

The receiver contour and sensitivity time control functions are inhibited. The antenna feed-port is re-phased, thus modifying the pencil beam by deflecting it downward in an equal energy fan type beam. This provides better illumination of ground targets. The waveguide switch connects the R/T to the waveguide.

The MAP mode provides a plan presentation of prominent topographical features. The broad beam radiated for the ground mapping function scans a selected range of earth with relatively equal consistency. The resultant reflection provides a display of prominent landmarks and terrain features, such as lakes, rivers, bays, islands, high ground, and cities. The presentation is in slant range and azimuth bearing is relative to aircraft heading. The display produced resembles the ordinary pilotage chart and is interpreted by a comparison of topographical features. Cities, open ground, and bodies of water are distinguished by reflected intensity of their returned signals. Cities normally provide the most intense reflections, with open ground and calm water providing progressively less intense returns.

Minor systems operation variations are introduced to the weather mapping function to provide the ground mapping function. In ground mapping mode, the sensitivity-time control and contour circuits are inhibited and antenna beaming characteristics are changed. The rf output, in weather mapping mode, is horizontally polarized and the pencil beam characteristics are determined by the antenna feed and reflector. The ground mapping function causes the output to change to vertical polarization.

With vertical polarization, the antenna feedhorn rotates 90-degrees to produce a vertical fan-like beam required for ground mapping.

The fan-like beam sweeps the selected sector of the earth as the antenna scans through a 180-degree horizontal arc. The indicator presentation is determined by returned signal strength, elapsed time and azimuth bearing, and is interpreted to identify target type, range, and direction.

F. TEST

R When TEST position is selected, test circuitry is energized after a 3.5 to 5.0-minute warm-up delay and a test pattern appears on the indicator. The selected R/T is disabled, but the antenna scans.

G. ANT TILT

The antenna tilt control, calibrated in 1-degree increments, provides remote control of antenna elevation and depression. The control positions the antenna reflector within an arc of UP 14- through DOWN 14-degrees.

H. GAIN

The GAIN control provides manual control of receiver gain. The gain is increased by clockwise rotation of the control. The detented full clockwise position (AUTO) provides an automatic gain control function. The gain control is operational only when MAP, CONT, or NORM positions are selected, and the gain control not in AUTO position.

NOTE: The weather radar system is designed to operate with gain control in AUTO position. The receiver minimum discernible echo level is calibrated with maximum receiver gain (AUTO). Clouds containing a rainfall rate below this minimum discernible level are intentionally omitted from the weather display, since their low turbulence is an acceptable normal flight condition. However, a manually decreased receiver gain may result in omission of significant weather formations and thereby reduce effectiveness of the system.

I. SYS 1 - 2 Switch

The SYStem 1 - 2 switch provides means for selection of desired system, R/T unit No. 1 or No. 2.

J. FAULT lights

R The ANT and/or R/T FAULT light comes on to signify a
R malfunction exists in either system 1 or system 2, and the
R antenna.

R 3. Indicators

R The indicator (Ref. Fig. 3) presents a 180-degree sector display
R of either weather radar data or ground-target returns at
R operator-selected ranges up to 300-nautical miles. Range and
R azimuth marks are provided to aid in navigation. The video data
R is presented on a cathode-ray tube (CRT) for a clear, non-fading
R display under all ambient lighting conditions.

R These indicators are fully interchangeable.

R THE indicator presents storm intensity levels as blank spots
R contrasted against lighted areas of the display.

R After proper evaluation, the flight crew can chart a course
R through or around these storm areas.

R The Captains and First Officers indicators are located on their
R respective instrument panels.

R The indicators are provided with independent controls to allow
R Captain and First Officer to adjust their displays individually.

R Operating controls are located on the front of each indicator
R housing and function as follows:

R A. RANGE Selector

R Simultaneously selects the indicator range scale and range
R marks. The range scales available are: A. IND
R OFF-LEFT-AHEAD-RIGHT SwitchThe switch may be used to turn
R indicator off while the rest of the system and the other
R indicator remain operational. The switch can be set to
R offset display so weather to left or right of flightpath, as
R well as straight ahead can be displayed. When set to AHEAD,
R indicator displays a symmetrical forward sector of
R 180-degrees. When set to LEFT, the apex of the display
R sector moves to right of the indicator; when set to RIGHT,
R the apex of the display sector moves to the left.
R Offsetting display left or right allows long range, left or
R right bearing targets (normally masked in AHEAD position) to
R be displayed on indicator. The range marks remain
R concentric with apex of display sector, allowing range
R information to be available during offset operation.

R NOTE: Indicator is turned on when switch is set to LEFT, AHEAD, or RIGHT. There is a 60-second warmup period required before display appears on indicator.

R B. INT Control

The INT control allows operator to raise or lower sensitivity threshold of indicator to signals applied by the selected R/T.

R C. RANGE MARKS CONTROL

The RANGE MARKS control adjusts brightness of range marks on display. The available adjustment is from high range mark brightness to dimmed beyond visibility.

R D. RANGE SELECTOR SWITCH

The range selector switch is used to select the operating range to be displayed. Three ranges may be selected: 30-, 100-, or 300-nautical miles. Each range is graduated by concentric range marks. When set to 30, one range mark is displayed at 25-nautical mile intervals. When set to 100, four range marks are displayed at 25-nautical mile intervals. When set to 300, six range marks are displayed at 50-nautical mile intervals.

R E. ERASE SWITCH

The ERASE switch is a press-and-release switch allowing rapid erasure of a previous display after a change of course. Pressing the switch causes the display to brighten (bloom) momentarily, fade, and then erase display.

R 4. Receiver-Transmitter (R/T)

The completely solid-state R/T unit (Ref. Fig. 4) utilizes a coaxial magnetron, solid-state modulator, duplexer-mixer assembly with flexible waveguide attached, self-test circuits, and performance monitoring circuits. The unit is mounted in the forward avionics rack in the Forward Electronic Service Center (FESC).

The R/T transmits and receives, computes antenna stabilization, and generates necessary dc operating voltages for the weather radar system. The R/T is contained within a full ATR case and mounted in a dual mounting tray equipped with quick disconnect waveguide fittings and a three-port waveguide switch. It is cooled by two blowers mounted on the front and rear of the case. The front panel of the case contains two test lamps, two annunciators, and three pushbutton switches used for isolating

faults in the R/T and antenna during stabilization subsystem self-test.

A LAMP TEST switch is provided on the front panel for checking operation of the two test lamps. The PITCH ADJ control located under an access cover on the front panel is used for calibrating the antenna pitch stabilization network. The front panel also contains MOD ON-OFF maintenance test switches. These switches allow the modulator to be disabled, preventing transmission
R after completion of the 3.5 to 5.0-minute warmup period.

The modulator can be re-activated by pressing the MOD ON pushbutton switch, or by pressing either STBY or OFF pushbuttons on the radar control panel. This allows the Captain and/or First Officer to re-activate the transmitter if maintenance personnel have inadvertently left the modulator disabled.

The major subassemblies comprising the R/T are; modulator, duplexer, receiver, stabilization circuits, power supply and control circuits (Ref. Fig. 4).

A. Modulator (Ref. Fig. 4)

The modulator is a solid-state device comprised of silicon controlled rectifiers and saturable reactors. Protective circuits are provided to protect against magnetron arcing, short circuiting, open circuiting, SCR lock-on and trigger loss. Automatic recovery is provided upon fault clearance.

B. Duplexer (Ref. Fig. 4)

The duplexer is a solid-state device. The separation between receiver and transmitter channels is performed by a ferrite circulator. Receiver isolation is provided by three switchable ferrite circulators in the receiver channel which are switched into a high attenuation condition during
R transmit mode.

C. Receiver (Ref. Fig. 4)

The receiver is a single conversion superheterodyne with a balanced mixer and local oscillator. An automatic sensitivity control circuit maintains a constant noise level at the receiver output by sampling the output just before the transmitter pulse.

D. R/T Stabilization Circuits (Ref. Fig. 4)

The antenna stabilization circuits consist of servo amplifiers and operational amplifiers using silicon rectifiers and integrated circuits. The antenna

stabilization circuits are provided with self-test capabilities.

E. Power Supply and Control Circuits (Ref. Fig. 4)

The power supply generates all dc operating voltages required for operation of the radar system. The control circuits located in the programmer module, perform the following; system time delay control functions, magnetron filament voltage control, antenna stabilization circuit power control and the required logic for system mode control (interface between R/T and control panel). With the
R exception of two relays and six transformers, the power supply and control circuits are completely solid-state devices.

5. Antenna (Ref. Fig. 4)

A. General

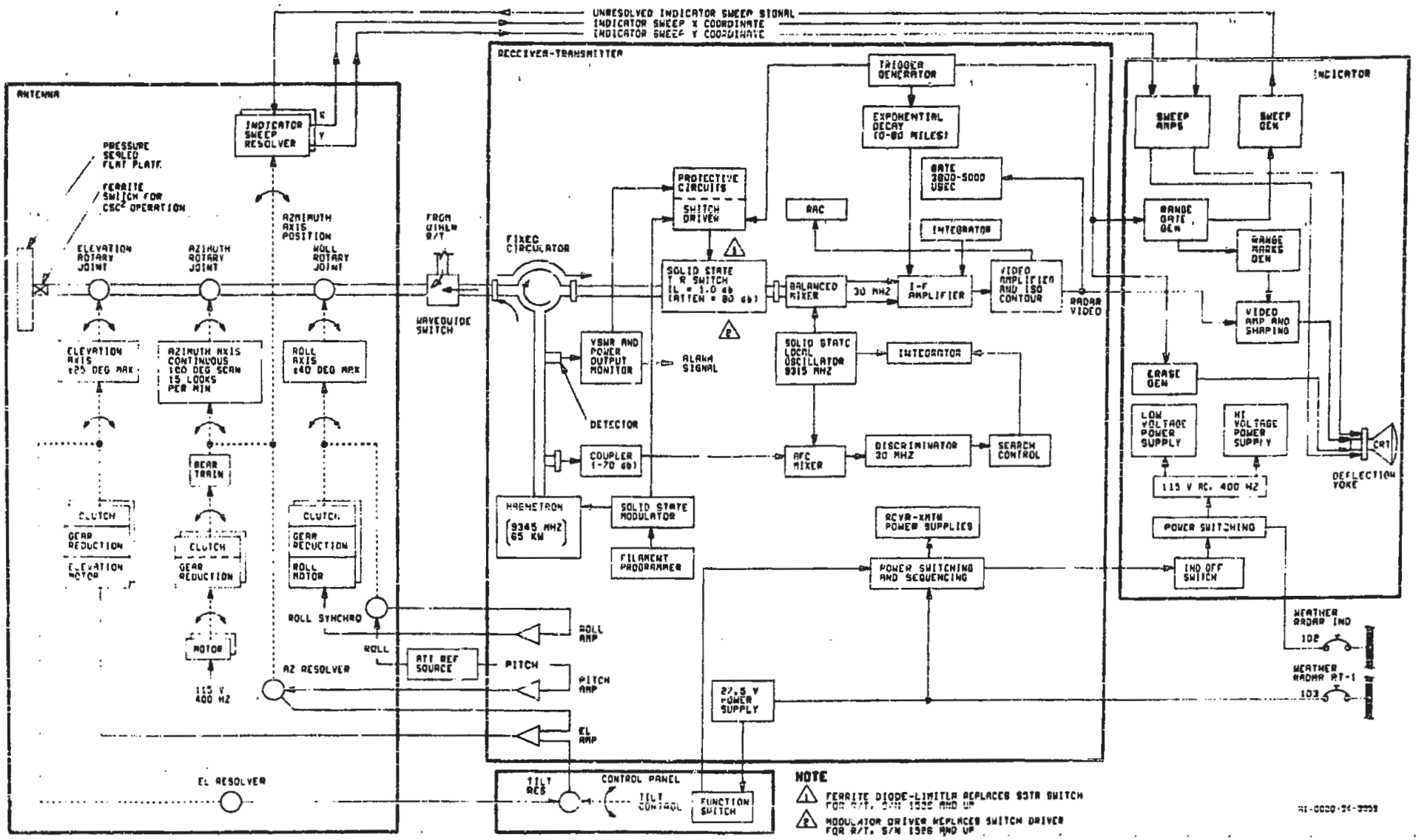
The antenna is located in the radome covered portion of the aircraft nose section. The antenna provides a transmitting and receiving function while scanning a 180-degree azimuth arc at a 15-look per minute rate. The antenna tilt angle determines the azimuth plane scanned. Antenna stabilization is provided to compensate for aircraft pitch and roll. The stabilization is accomplished by attitude reference system, pitch and roll information which is processed and utilized to introduce corresponding changes to the antenna rotation planes.

The antenna feed and reflector radiates either a pencil beam for weather mapping function, or a vertical fan-like beam for ground mapping function. The pitch and roll stabilization assemblies, tilt assemblies, azimuth assemblies, and RF (waveguide) assembly are contained within the antenna pedestal and linkage housing.

The antenna radiates pulsed radar signals, these signals are reflected from objects external to the aircraft. The antenna is driven in the azimuth plane to scan a 180-degree area ahead of the aircraft. The antenna SCAN DISABLE switch, located on the antenna roll mounting base, is used to stop scan movement of the antenna for maintenance purposes by opening the antenna azimuth drive motor return line.

B. Antenna

The antenna is an X-band radiator that produces a high gain 2.7-degree pencil beam with very low side lobes when in



R Weather Radar System Functional Diagram
R Figure 4

R EFFECTIVITY: ALL

001B

weather detection mode. In ground-mapping mode, the beam pattern becomes an elongated ellipse illuminating ground targets ahead of the aircraft. The ground-mapping mode is obtained by re-phasing the antenna by rotating the feedhorn 90-degrees, thus modifying the weather detection pencil beam by deflecting it downward in an equal-energy CSC^2 (fan-type) beam. This provides better illumination of ground targets.

C. Waveguide Switch (Ref. Fig. 4)

A three port waveguide switch is mounted at the rear of the R/T mounting rack. The switch connects the antenna to either R/T unit depending on position of system 1 - 2 switch.

6. Operation

A. Video Generation and Display (Ref. Fig. 4)

(1) The filament programmer starts when the weather radar is turned on (STBY, NORM, CONT, MAP, or TEST), regardless of which R/T is selected; each R/T begins a3.5 to 5.0-minute warmup period. The R/T not selected is maintained in standby mode..

R

(2) The magnetron output is applied through a fixed circulator to the waveguide switch, which connects either R/T No. 1 or R/T No. 2 to the antenna, depending on the R/T selected at the control panel. During receive mode, the T-R switch and fixed circulators pass received RF to the balanced mixer, supplying 30-MHz difference frequency to the IF amplifier. A sample of the transmitted pulse is coupled to the AFC mixer to be compared with the local oscillator frequency, keeping the IF tuned.

(3) The trigger generator is range-gated and applied to the sweep generator, supplying unresolved sweep to the antenna. The antenna furnishes resolved X and Y sweep to the indicator sweep amplifiers, which in turn drive the deflection yoke. The trigger generator output is also supplied to the erase generator to erase the display.

(4) The range gate generator is controlled by the RANGE switch, it supplies the selected gate to the range marks generator. The range marks are added to the video in the amplifier and shaping circuits, and applied to the display storage tube. During iso-echo contour operation (CONT selected on control panel), radar video is invested to furnish a negative display;

this causes the center of the storm to appear as a black spot.

B. Radar Indicators

(1) Description

The indicator is a five-inch display storage tube (DST) with a polaroid filter. Weather radar returns, or terrain target range and bearing returns, are displayed in a 180-degree sector, plan position indicator (PPI) display. The indicator uses electromagnetic deflection with electrostatic focus, and has a resolution of 60-lines to the inch.

The indicator contains timing circuits, video and sweep amplifiers, power supplies and associated circuits for controlling the viewing beam and writing beam in the DST (Ref. Fig. 4). The timing circuits include a range rate generator, range marker generator, sweep generator and resolver driver. These circuits provide a PPI display of target returns received from the antenna and R/T.

The indicator contains continuously monitoring fault isolation test circuits to assist in localizing malfunctions associated with indicator/antenna interface at the indicator sweep resolver on the antenna.

Radar video data is amplified and processed (shaped) in the indicator. The range selector switch on the indicator front panel selects both the range to be displayed and the range markers to be added to the video signal. When the range selector switch is set to the desired range scale, the pulses that generate the appropriate range markers are added to the receiver video signal in the video amplifier and shaping circuits.

The sweep information (X and Y axes) is applied to the DST deflection yoke as the sweep is generated by the indicator sweep resolver on the antenna. The basic sweep waveform, generated in the scan sawtooth, is resolved into X and Y components by applying a single (unresolved) sweep signal from the sweep generator in the indicator to the sweep resolver on the antenna. The sweep resolver output signal (200-Hz sweep sawtooth) is applied to one winding and goes out on two orthogonal windings (at right-angles to each other) resolved into X and Y components. The X and Y components are applied to the indicator sweep

amplifiers (one for horizontal and one for vertical). The outputs of the sweep amplifiers then drive the deflection yoke.

(2) OperationThe DST utilizes two independent electron guns, the write gun and view gun. The write gun provides a high-velocity electron beam which is intensity-modulated with information and deflected proportional to range and azimuth. The high-velocity beam is used to energize or write on a film of dielectric material on a fine mesh screen, the storage mesh. An electrostatic charge proportional to the write beam intensity is stored on the storage mesh. The view-gun output is a low-velocity flood beam which passes through the energized portions of the storage mesh and excites the phosphor on the face of the DST. To erase the electrostatic charge from the storage mesh, positive erase pulses are applied to it. When the erase pulses are applied to the storage mesh, the storage mesh becomes negatively charged and retards the view beam.

The gates generated by the range gate multivibrator are initiated by the system trigger. The gates establish the sweep and range marker time-base interval and actuate circuits to sensitize the display during the range or display interval.

The displayed sweep line is synchronized with the azimuth position of the antenna by the antenna azimuth sweep resolver. Sweep waveform data generated in the indicator is applied to the rotor of the antenna azimuth sweep resolver. The resolver is mechanically geared to the azimuth axis shaft on the antenna structure. The resolver rotor and the antenna reflector rotate synchronously in a one-to-one ratio. The stator outputs are resolved into sweep waveforms which have amplitudes proportional to the position of the antenna axis shaft. The stator windings are wound at electrical right angles (orthogonal windings), so the stator outputs provide both horizontal (X) and vertical (Y) axis information applied to the indicator sweep amplifiers and the DST deflection yoke.

The two sweep amplifiers (X and Y axis) provide impedance matching between the antenna azimuth resolver stator windings (high impedance) and the DST deflection yoke (low impedance). The amplifiers drive currents through the deflection yoke (two right-angle deflection coils). The vector sum (resultant) of the two deflection coil fields causes the radial sweep lines to scan through a display angle synchronized to the antenna azimuth scan.

The video amplifier provides a constant target intensity display regardless of target range or relative bearing. Without the performance of this function, low-level targets would be displayed near the center of the display only and would not be detectable on the outside areas, and high level targets would saturate the display causing blooming at close-in ranges. Sensitivity to low-level signals and video noise is made range-independent by tilting or sloping the video baseline so a uniform target threshold level is maintained over the display area for the selected range. The high-level signals are shaded by applying video to a limiter circuit which is time-modulated so the limit-level increases with range. The limiter circuit suppresses the peak amplitude of close-in strong targets so the intensity can be set on the noise threshold to reduce indicator blooming caused by strong, close-in or short-range target returns.

A positive-going square wave intensity gate and a saw tooth slope voltage are mixed with the video output at the video driver causing the video applied to the DST writing-gun to be superimposed on a pedestal with a sloping baseline. The pedestal gates the display to threshold level during the selected range interval and blanks it during sweep retrace. The pedestal baseline is sloped to provide a uniform threshold level over the selected range allowing sensitivity to low-level signals to be maintained.

The indicator generates timed range-markers and displays them as bright concentric arcs. Range marker timing signals are provided by an oscillator which is gated-on synchronously with the selected display range interval and gated-off during the retrace interval.

The DST writing process consists of modulating the storage mesh with a beam of electrons from the writing gun and creating secondary emission. The secondary emission electrons are drawn to the collector mesh, leaving the storage mesh at a more positive potential over those areas which have been modulated by the writing beam. The viewing beam now passes only through the modulated (more positive) areas on the storage mesh and excites the phosphor screen, displaying target return data.

The erasing process discharges the storage mesh areas which have been charged (made more positive) by the writing beam. The storage mesh is discharged to a potential of -6 volts. At this potential, the viewing beam is cut-off with respect to passage of electrons through

the storage mesh and no target data return data will appear on the display.

C. Antenna Stabilization (Ref. Fig. 4)

The antenna is provided with a split-axis, which allows signals from the aircraft attitude reference system (Ref. 34-21-00, 34-43-00) to stabilize the roll axis independent of the azimuth or elevation axes so only the elevation axis needs correction for aircraft pitch and azimuth scan. The reflector and feed assembly move together in both azimuth and elevation; consequently, the radiation pattern remains constant over the full range of movements.

All antenna stabilization and azimuth electro-mechanical components are duplicated, providing a redundancy allowing independent operation of the antenna by system No. 1 or system No. 2.

When system No. 1 is in operation, all necessary system operating voltages and signals are provided by R/T No. 1. System No. 1 also provides a dc voltage used to energize and de-cluth all antenna system No. 2 clutches, causing all gear train loads to be disconnected.

The antenna tilt circuit controls the vertical angle of the antenna beam relative to the horizon. The antenna radiator may be set to tilt angles of 14-degrees up, and 14-degrees down. The amount of tilt is controlled by the antenna tilt control on the radar indicator panel.

When the position of the tilt control is changed, voltage from the antenna elevation resolver, via the antenna tilt resolver on the indicator, is amplified by the elevation amplifier in the R/T and applied to the antenna elevation drive motor to tilt the antenna radiator by the amount set into the antenna tilt control. The antenna elevation motor also positions the rotor of the antenna elevation resolver to null-out the elevation servo loop. When the loop is nulled-out, voltage is no longer applied to the antenna elevation drive motor and the motor stops.

D. Self Test and Fault Monitoring

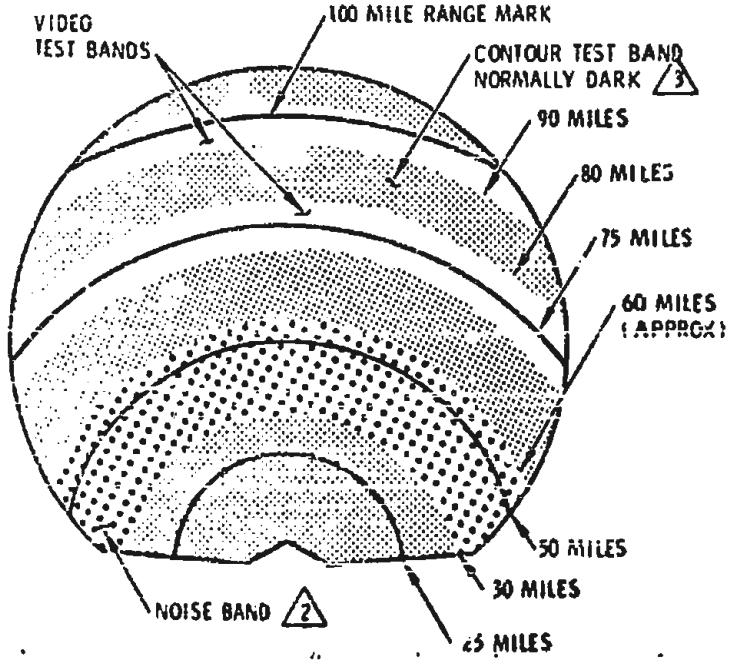
The self-test features incorporated in the radar system provide a means of evaluating system performance, on the ground or while airborne, with minimum interruption to normal system operation. When TEST position is selected, a special test pattern is generated (Ref. Fig. 5) for evaluation of a large portion of system operation.

In addition, the radar system incorporates fault isolation circuitry in the form of function monitors. The monitors provide a visual indication on R/T unit front panel and radar control panel, of an existing malfunction within the system.

The test pattern, in conjunction with fault lamps provide a capability for detecting most system malfunctions without requiring additional test equipment.

(1) Test Mode

When TEST position is selected, the control panel causes two simulated signals to be injected into the system to provide a special test pattern on the indicator display. One is a noise signal which is applied to the receiver input for the first 70-miles of sweep, and the other a triangular video-pulse signal which occurs between 70- and 100-miles. The noise signals intensity is such that STC action can be verified from the appearance of the display. The second signal has an amplitude exceeding the iso-contour threshold and creates two bright annular bands when iso-counter action is normal.



NOTE

1 TEST PATTERN IS SHOWN USING THE 100NM RANGE

2 NOISE CAN INCREASE FROM 30 MILES DOWN TOWARD 0 MILES. RADAR IS STILL USABLE, BUT STC HAS DETERIORATED

3 CONTOUR TEST BAND MAY INCREASE IN WIDTH. RADAR IS STILL USABLE BUT CONTOUR LEVEL IS LOWER THAN NORMAL

MI-0002-34-297

R Weather Radar Test Pattern
R Figure 5

R The test display is useful in adjusting indicator
R controls prior to use of the system and gives a visual
R indication the R/T and indicator are operating. With
R system in TEST, the fault lamps on the control panel
R are energized to test for lamp failure.

R (2) Fault Monitors

R Two latching annunciators, on front of R/T, are used to
R show antenna or R/T faults; a fault in the antenna
R stabilization circuits will trip both annunciators.

R The fault monitoring results in two fault buses; one
R for the R/T, and one for the antenna. If a fault
R exists on either bus for greater than 45-seconds, the
R appropriate fault annunciator will trip.

R (3) The ANT fault monitor checks four antenna parameters.

R (a) A fault voltage for the antenna sweep resolver is
R supplied from the resolver fault monitor circuit
R in the indicator.

R (b) The clutch current monitor measures total clutch
R current by measuring the voltage drop across a
R voltage-dropping resistor.

R (c) The circuit-leakage and VSWR monitoring circuit
R measures the detected rf transmitted pulse
R appearing at the receiver port of the fixed
R circulator. A high-level VSWR at the antenna
R reflects a high-level rf pulse into the receiver
R port. If VSWR or leakage is high, the monitoring
R circuit supplies a fault voltage to the antenna
R fault bus and momentarily inhibits the transmitter
R (modulator disable). Since both power-monitor and
R AFC monitor will generate faults when the
R transmitter is OFF, the VSWR monitor disables
R these two monitors.

R (d) The stabilization servos are monitored, but a
R detected fault trips both fault buses because a
R stabilization fault could result from either a
R defective servo amplifier or antenna.

R (4) The R/T fault monitor may be tripped by seven R/T
R parameters as follows:

R (a) The stabilization servos are monitored as above.

(b) Loss of 28-volt switching power, or delayed DC voltage rectified in the antenna from delayed AC stabilization power will cause an R/T fault.

(c) The AFC comparator monitors search-track voltage in the AFC module. A fault is detected if the AFC module remains in search mode.

(d) The local oscillator power is monitored by measuring mixer diode current.

(e) The STC monitor checks the Sensitivity Timing Control pulse supplied by the trigger generator. During MAP mode, STC monitoring is inhibited.

(f) The AGC monitor compares the AGC bus and the reference to ensure presence of AGC.

(g) Magnetron output power is detected at a waveguide coupler at the Magnetron. Low power will cause an R/T fault.

(5) Fault monitoring is inhibited during warm-up time delay, during TEST mode, and if the MOD OFF pushbutton is pressed to prevent false fault indications.

The ANT and RT fault lights on control panel operate in conjunction with latching annunciators on R/T unit front panel. However, the latching annunciators stay latched until reset, whereas the fault lights go out when the radar system is turned OFF.

D. To Operate System

(1) Preparation

WARNING: DO NOT OPERATE RADAR DURING REFUELING OPERATIONS, OR IN VICINITY OF TRUCKS OR CONTAINERS CONTAINING FLAMMABLE OR EXPLOSIVE LIQUIDS.

CAUTION: AIRCRAFT MUST BE IN FLIGHT LINE RADAR TEST POSITION BEFORE OPERATING RADAR IN ANY OPERATIONAL MODE OTHER THAN STANDBY OR TEST.

NOTE: The weather radar system is equipped with self-test features providing for a rapid check of system operation on the ground or while airborne. The ground procedures enumerated below are also applicable for airborne checks.

(a) Set INTENSITY control on radar indicator fully counter-clockwise.

(b) Set indicator RANGE control to 100-mile range position.

(c) Place control panel ANT TILT control to 10-degrees UP.

(d) Set control panel GAIN control to AUTO position.

(e) Energize aircraft electrical buses.

(f) Press TEST pushbutton on control panel.

NOTE: Test mode will be operative after approximately 20-seconds, however, transmitter will not be operative until
R approximately 3.5 to 5.0-minutes.

(g) Adjust INTENSITY control for convenient viewing level.

(h) Observe test pattern on indicator, a satisfactory pattern indicates an operational system.

R (i) 3.5 to 5.0-minutes from initial turn-on, transmitter will be operative and test pattern must not change.

(2) Operation

(a) Press pushbutton on control panel corresponding to desired mode of operation.

NORM, for normal weather search operation

CONT, for normal weather search plus contour circuit operation

MAP, for ground mapping function.

(b) To shut down system, press OFF pushbutton on control panel and de-energize aircraft electrical buses.

WEATHER RADAR - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If flight crew reports a trouble using a fault code, the code can be found in the Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for more detailed duscussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

R To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Weather Radar - Safeguards Against Radiation Hazards

A. Precautions

C The micro-wave energy emitted (transmitted) from an operating weather radar system is of moderate intensity with an average power of 50 to 70 watts. Aircraft weather radar systems emit energy only in the forward 270 degrees around the aircraft nose. No energy is transmitted toward the cockpit. Although energy transmitted is of moderate intensity, there is cause for concern regarding excessive exposure, therefore the following precautions should be observed:

(1) The weather radar system can be tested in many functions with the magnetron de-energized. If system

tests do not require magnetron use, turn it off as outlined in the maintenance manual.

(2) Aircraft weather radar systems should be tested or operated only by authorized, qualified personnel.

(3) Aircraft weather radar systems should not be operated while aircraft is in hangar, facing large nearby objects, or in an area congested with people unless magnetron is deactivated or R.F. energy is dissipated into a dummy load designed to absorb radio frequency energy.

(4) Personnel testing weather radar systems should take adequate precautions that no person is in the scanning path of the antenna of an operating weather radar system closer then 46 feet for an AVQ30X Weather Radar. No person should be within 80 feet of the antenna if it is transmitting and not scanning. These limits have been established as the minimum safe distances to prevent excessive absorption of the radiated energy. The only sensation a human would feel from excessive exposure is internal warmth. The eyes and the reproductive glands are the most vulnerable parts of the body.

(5) Personnel testing a weather radar system should make every effort to assure that no person wearing a PACEMAKER heart stimulator is in the path of a radiating antenna, scanning or not. Precautions against such problems must be a part of weather radar maintenance.

(6) Do not operate the weather radar system on an aircraft that is being fueled, or when other aircraft within 100 feet of the antenna are being fueled or within 100 feet of bulk fuel storage tanks. These distances are obviously not applicable if the magnetron is deactivated to prevent radiation.

(7) When working on the waveguide, make sure the radar magnetron is OFF and will remain OFF until the waveguide work is completed. DO NOT operate the radar and antenna system with the magnetron energized without either the waveguide or a dummy load attached.

(8) Never look into the waveguide or into an open-ended coaxial connector of the weather radar system with the system operating. Eye injury could be incurred due to the power and concentration of radio frequency energy.

C (9) Photographic flash bulbs (especially No. 5 or 5B) can
C be fired by an operating weather radar system at
C distances closer than 25 feet.

3. Supplemental Fault Isolation Data

The weather radar system has self-test provisions which are used to test and aid in making operating adjustments. The weather radar system self-test provisions are of two general types: on-line monitoring for automatic fault indication, and an operator-actuated test (BITE) to aid in fault isolation and making operating adjustments. Fault isolation to seven line-replaceable units (LRU) is accomplished by combining self-test provisions with operator-actuated tests. Figures 104
R through 110 provide fault isolation procedures and specifies the corrective action to be performed.

A. On-line Monitoring

On-line monitoring provides fault isolation for receiver-transmitter and antenna. A fault in either is
R indicated by two lamps located on weather radar control panel, and two latching-type annunciators located on front panel of receiver-transmitter. The control panel lamps are bracketed FAULT, and marked ANT (antenna) and RT (receiver-transmitter). The latching-type annunciators on receiver-transmitter are marked ANT and RT. The fault lamps and latching-type annunciators on control panel and receiver-transmitter, function together to indicate a circuit has deviated from a preset performance level. This does not necessarily mean system is inoperative.

Optimum performance of the weather radar system is determined by a display on the weather radar indicators in TEST mode (Ref. Fig. 103).

The FAULT lamps on control panel and latching-type annunciators on R/T unit, determine whether the indicated fault is associated with antenna or receiver-transmitter.

If both control panel FAULT lights come on, the fault could be associated with antenna and receiver-transmitter, or only one. If a failure occurs in antenna, the ANT FAULT light will come on and the ANT fault lamp on receiver-transmitter will latch (Ref. Table 101). If a failure occurs in the receiver-transmitter, the RT FAULT light will come on and the RT latching-type annunciator on receiver-transmitter will latch.

On-Line Monitoring Fault Indication Interpretations
Table 101

OPERATING PARAMETERS AND SIGNALS BEING MONITORED	FAULT INDICATION
Transmitter power output	RT lamp and RT annunciator
Control signals from receiver-transmitter to indicator and antenna (on-off and high voltage)	RT annunciator
Receiver sensitivity	RT lamp and RT annunciator
Sensitivity time control signal	RT lamp and RT annunciator
AFC lock-on	RT lamp and RT annunciator
Local oscillator power level (crystal current)	RT lamp and RT annunciator
Reflected power incident on solid-state transmit/receive switch	ANT lamp and ANT annunciator
Antenna clutch current	ANT lamp and ANT annunciator
Antenna sweep voltage	ANT lamp and ANT annunciator
Servo error signal levels (stabilization circuits)	Both; RT and ANT lamps, and annunciators

The annunciators on R/T units, once tripped (latched) to the fault-indicating position, will remain in that position until manually reset.

NOTE: Turning weather weather radar system off, does not reset receiver-transmitter fault annunciators.

If a malfunction corrects itself, the applicable fault lamp on control panel goes out, but the latching - type annunciator on applicable receiver-transmitter front panel stays tripped (latched). This enables maintenance ground crews to tell which LRU had the failure.

B. Operator-actuated Test

An operator-actuated test (BITE) is performed by depressing TEST mode switchlight on control panel. This causes two

simulated test signals to be injected into the weather radar system to produce a test pattern on indicator display (Ref. Fig. 103). One is a noise signal which is applied to the receiver input, the other is a triangular video pulse which occurs between 70 and 100-miles. The first signal is pulsed-on during the first 60 miles of the range sweep. The test signal intensity is such that STC action can be verified on test display.

The second signal has an amplitude that exceeds the iso-contour threshold and creates two bright angular bands when iso-contour operation is normal. These two test signals are useful in adjusting the indicator prior to takeoff. They also give pilot a visual indication that receiver-transmitter and indicator are operating. When weather radar system is in TEST mode, FAULT lamps on control panel are on. This provides a lamp test.

C. Technician-actuated Test

Fault lamp and annunciator monitoring, and indicator display evaluation in normal operating modes and TEST (BITE), provide effective fault isolation.

BITE should be used and results evaluated first. The detailed checkout items should be performed as a followup to BITE. The detailed test options highlight LRU performance.

4. Fault Isolation Identification

R Table 102 lists the fault isolation diagrams and schematics in
R this section. Figures 101 and 102 provide component locations
R for Weather Radar System.

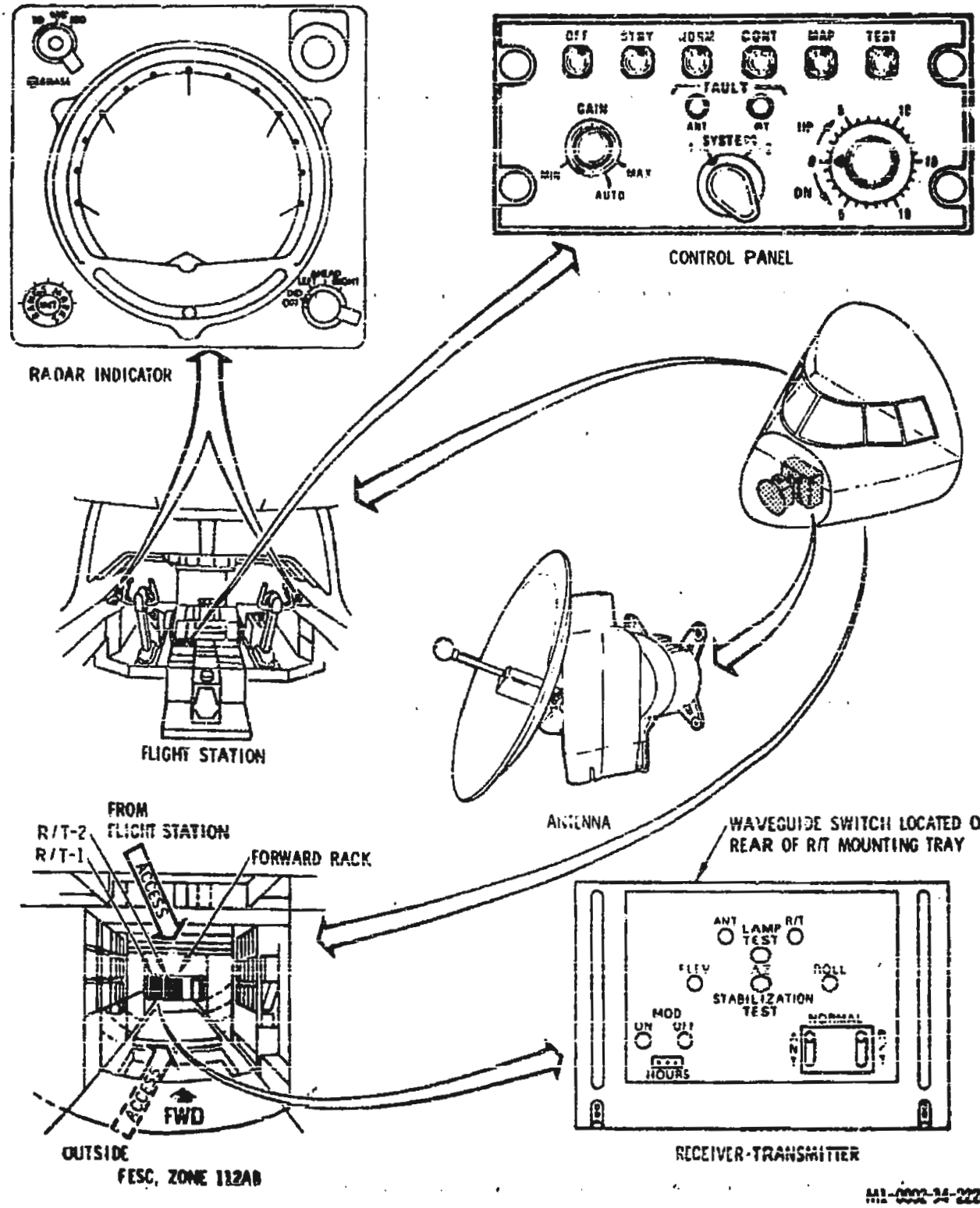
Fault Isolation Diagrams and Schematics List
Table 102

FIGURE NUMBER	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Weather Radar Test Pattern
104	Antenna Stability Fault
105	Targets Weak - All Modes
106	CONTOUR/MAP Mode(s) Inoperative
107	Faulty Test Pattern - Either Indicator
108	Antenna Tilt Fault
109	Abnormal Indicator Faults
110	False Targets (Echoes)
111	Fault Light Reported On - One or Both
SCHEM 1 (Sheet 1)	Weather Radar System (R/T No. 2 and Control Panel) Schematic
SCHEM 1 (Sheets 2 and 3)	Weather Radar System (R/T No. 1 and Waveguide Switch) Schematic
SCHEM 1 (Sheet 4)	Weather Radar System (Indicator) Schematic
SCHEM 1 (Sheet 5)	Weather Radar System (Antenna) Schematic
SCHEM 2	Weather Radar Control Panel Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA – WEATHER RADAR	1	RADOME	34-44-03
INDICATOR – WEATHER RADAR	2	FLT STA, CAPT AND F/O INSTR PNL	34-44-05
PANEL – WEATHER RADAR CONTROL	1	FLT STA, CTR CSL	34-44-03
RECEIVER/TRANSMITTER – WEATHER RADAR	2	FESC, FWD RACK/112AB	34-44-01
SWITCH – WAVEGUIDE	1	FESC, FWD RACK/112AR	34-44-10

M1-0000-34-016

R Component Location Index
R Figure 101



M1-0002-34-2224

R Component Locator Diagram
R Figure 102

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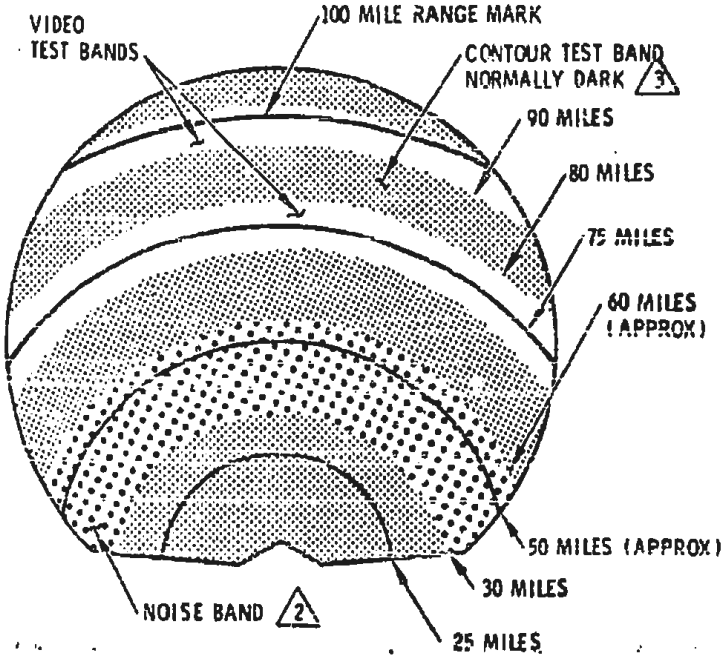


NOTE

1 TEST PATTERN IS SHOWN USING THE 100NM RANGE

2 NOISE CAN INCREASE FROM 30 MILES DOWN TOWARD 0 MILES. RADAR IS STILL USABLE, BUT STC HAS DETERIORATED

3 CONTOUR TEST BAND MAY INCREASE IN WIDTH. RADAR IS STILL USABLE BUT CONTOUR LEVEL IS LOWER THAN NORMAL

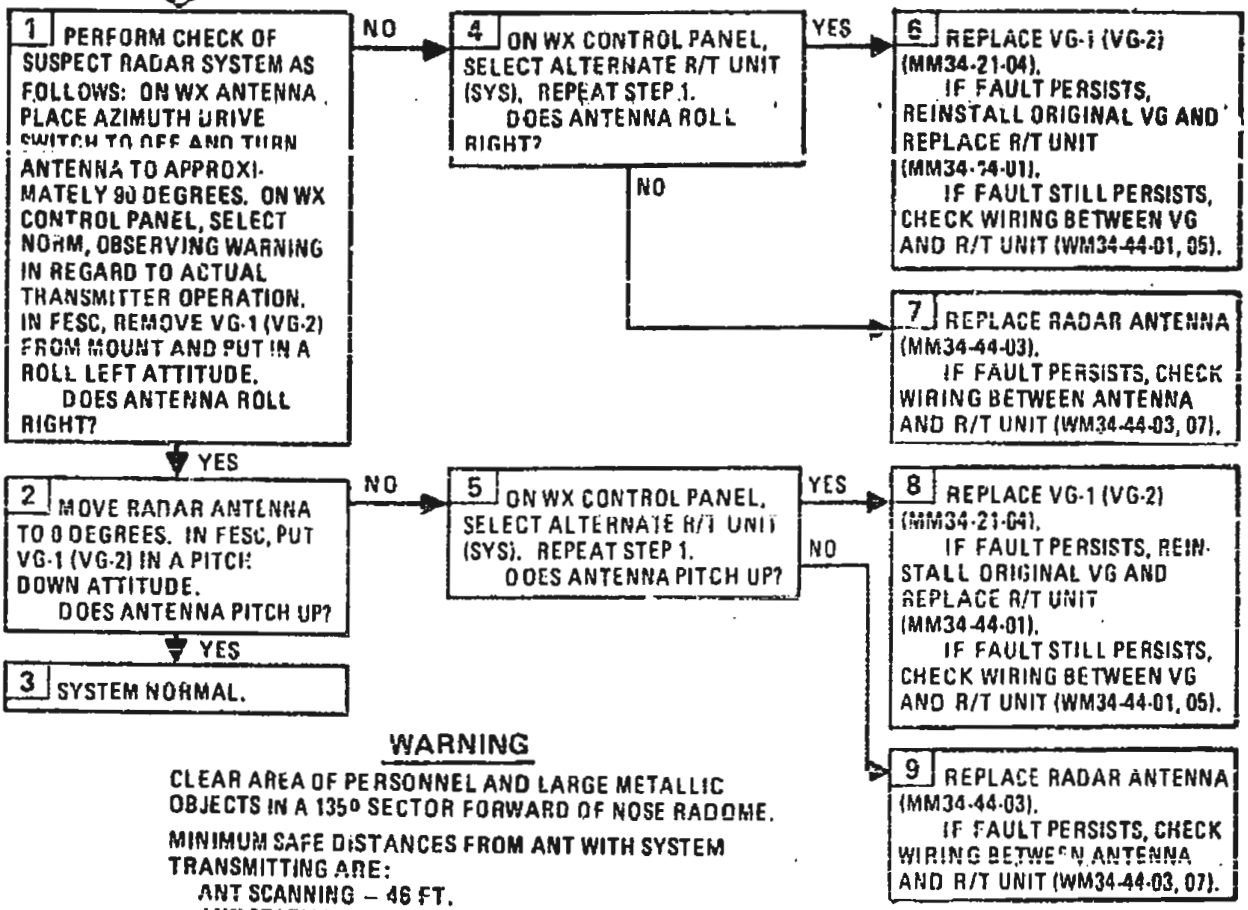
MI-0001-34-292

Weather Radar Test Pattern
Figure 103

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR -- LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL
ANT TILT CONTROL SET TO 14° UP
SYSTEM 1-2 TO SYSTEM UNDER TEST
VERTICAL GYROS NO. 1 AND 2 ERECTED AND RELEASED FROM THEIR MOUNTS
TWO MEN REQUIRED: ONE IN FESC AND ONE OUTSIDE TO OBSERVE ANTENNA (RADOME OPEN)

ANTENNA STABILITY PROBLEM ON BOTH INDICATORS – CAPT (F/O) ADI ATT FLAG MAY BE IN VIEW


1 PERFORM CHECK OF SUSPECT RADAR SYSTEM AS FOLLOWS: ON WX ANTENNA PLACE AZIMUTH DRIVE SWITCH TO OFF AND TURN ANTENNA TO APPROXIMATELY 90 DEGREES. ON WX CONTROL PANEL, SELECT NORM, OBSERVING WARNING IN REGARD TO ACTUAL TRANSMITTER OPERATION. IN FESC, REMOVE VG-1 (VG-2) FROM MOUNT AND PUT IN A ROLL LEFT ATTITUDE. DOES ANTENNA ROLL RIGHT?
NO
4 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT (SYS). REPEAT STEP 1. DOES ANTENNA ROLL RIGHT?
YES
6 REPLACE VG-1 (VG-2) (MM34-21-04). IF FAULT PERSISTS, REINSTALL ORIGINAL VG AND REPLACE R/T UNIT (MM34-44-01). IF FAULT STILL PERSISTS, CHECK WIRING BETWEEN VG AND R/T UNIT (WM34-44-01, 05).
NO
7 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, CHECK WIRING BETWEEN ANTENNA AND R/T UNIT (WM34-44-03, 07).
YES
2 MOVE RADAR ANTENNA TO 0 DEGREES. IN FESC, PUT VG-1 (VG-2) IN A PITCH DOWN ATTITUDE. DOES ANTENNA PITCH UP?
NO
5 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT (SYS). REPEAT STEP 1. DOES ANTENNA PITCH UP?
YES
8 REPLACE VG-1 (VG-2) (MM34-21-04). IF FAULT PERSISTS, REINSTALL ORIGINAL VG AND REPLACE R/T UNIT (MM34-44-01). IF FAULT STILL PERSISTS, CHECK WIRING BETWEEN VG AND R/T UNIT (WM34-44-01, 05).
NO
9 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, CHECK WIRING BETWEEN ANTENNA AND R/T UNIT (WM34-44-03, 07).
YES
3 SYSTEM NORMAL.

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 46 FT.
ANT STATIONARY – 60 FT.
FROM REFUELING OPERATION – 100 FT.

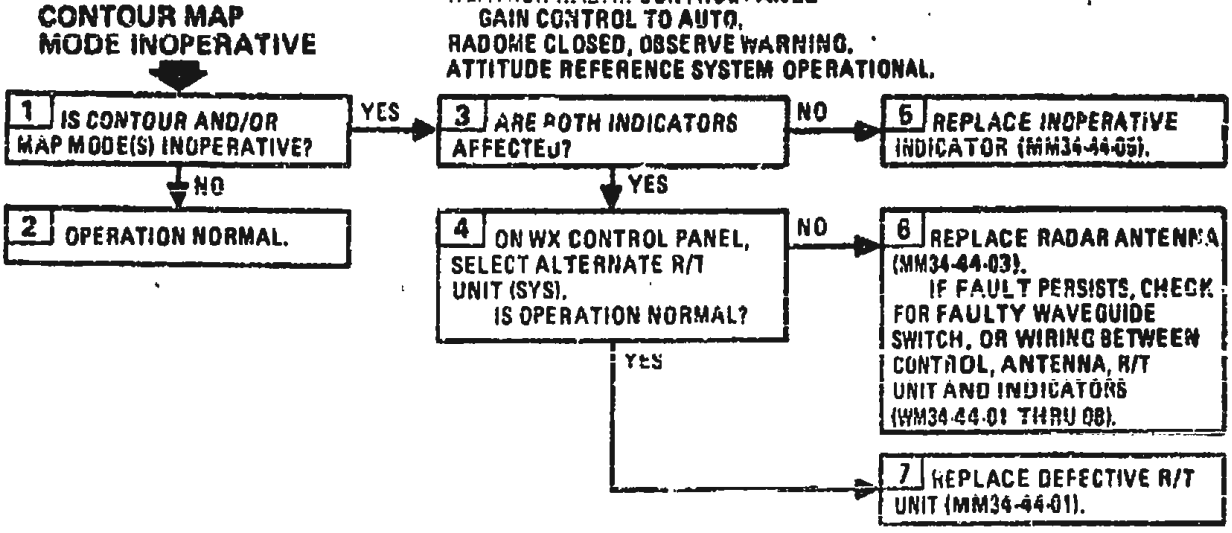
NOTE

1 IF CAPT OR F/O ADI HAS ATT FLAG IN VIEW AND MAINTENANCE ANNUNCIATOR ON VG IS YELLOW, THE STABILITY PROBLEM IS PROBABLY A DEFECTIVE VG.
2 ALLOW 5 MINUTES WARMUP OF SYSTEMS BEFORE STARTING TEST.
3 AT CONCLUSION OF TESTING:
ON WX CONTROL PANEL, SELECT OFF.
ON WX ANTENNA, PLACE AZIMUTH DRIVE SWITCH TO ON.
SECURE VERTICAL GYROS.

M1-0000-34-4222

Antenna Stability Fault
Figure 104

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR-LO FLO COOLING LIGHTS ON FE/SO EC8 MONITOR PANEL ARE OUT.
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL
GAIN CONTROL TO AUTO.
RADOME CLOSED, OBSERVE WARNING.
ATTITUDE REFERENCE SYSTEM OPERATIONAL.


CONTOUR MAP MODE INOPERATIVE
1 IS CONTOUR AND/OR MAP MODE(S) INOPERATIVE?
YES
3 ARE BOTH INDICATORS AFFECTED?
NO
5 REPLACE INOPERATIVE INDICATOR (MM34-44-05).
NO
2 OPERATION NORMAL.
YES
4 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT (SYS). IS OPERATION NORMAL?
NO
6 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, CHECK FOR FAULTY WAVEGUIDE SWITCH, OR WIRING BETWEEN CONTROL, ANTENNA, R/T UNIT AND INDICATORS (WM34-44-01 THRU 08).
YES
7 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 40 FT.
ANT STATIONARY – 90 FT.
FROM REFUELING OPERATION – 100 FT.

NOTE
ALLOW 5 MINUTE WARMUP BEFORE STARTING TEST

M1-0000-34-4223

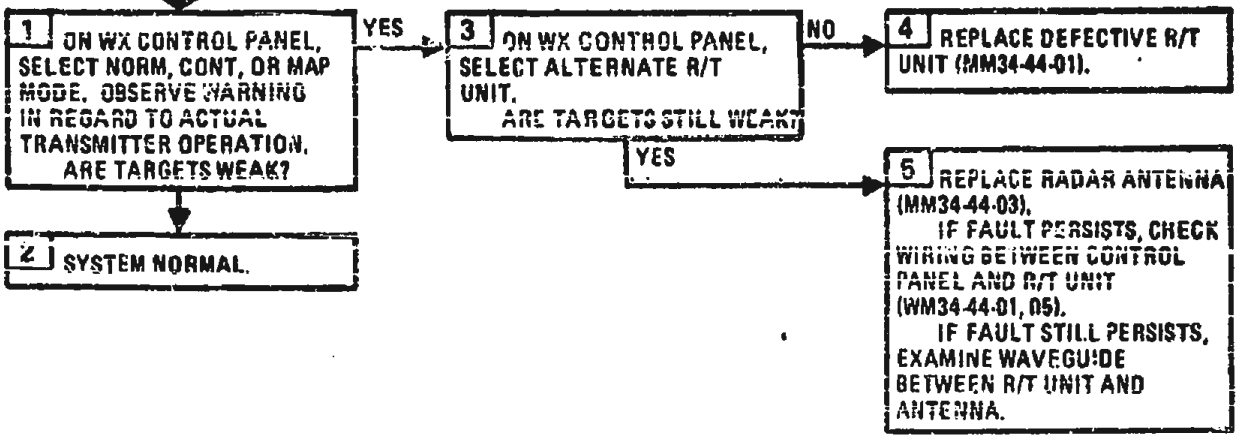
R Targets Weak - All Modes
R Figure 105

EFFECTIVITY: ALL

0018

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR–LO FLO COOLING LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT.
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL
SYSTEM 1-2 TO SYSTEM UNDER TEST.
GAIN CONTROL AS NEEDED
RADOME CLOSED, OBSERVE WARNING
ATTITUDE REFERENCE SYSTEM OPERATIONAL

TARGETS WEAK – ALL MODES


1 ON WX CONTROL PANEL, SELECT NORM, CONT, OR MAP MODE. OBSERVE WARNING IN REGARD TO ACTUAL TRANSMITTER OPERATION. ARE TARGETS WEAK?
YES
3 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT. ARE TARGETS STILL WEAK?
NO
4 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).
YES
5 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, CHECK WIRING BETWEEN CONTROL PANEL AND R/T UNIT (WM34-44-01, 05). IF FAULT STILL PERSISTS, EXAMINE WAVEGUIDE BETWEEN R/T UNIT AND ANTENNA.
2 SYSTEM NORMAL.

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 46 FT.
ANT STATIONARY – 90 FT.
FROM REFUELING OPERATION – 100 FT.

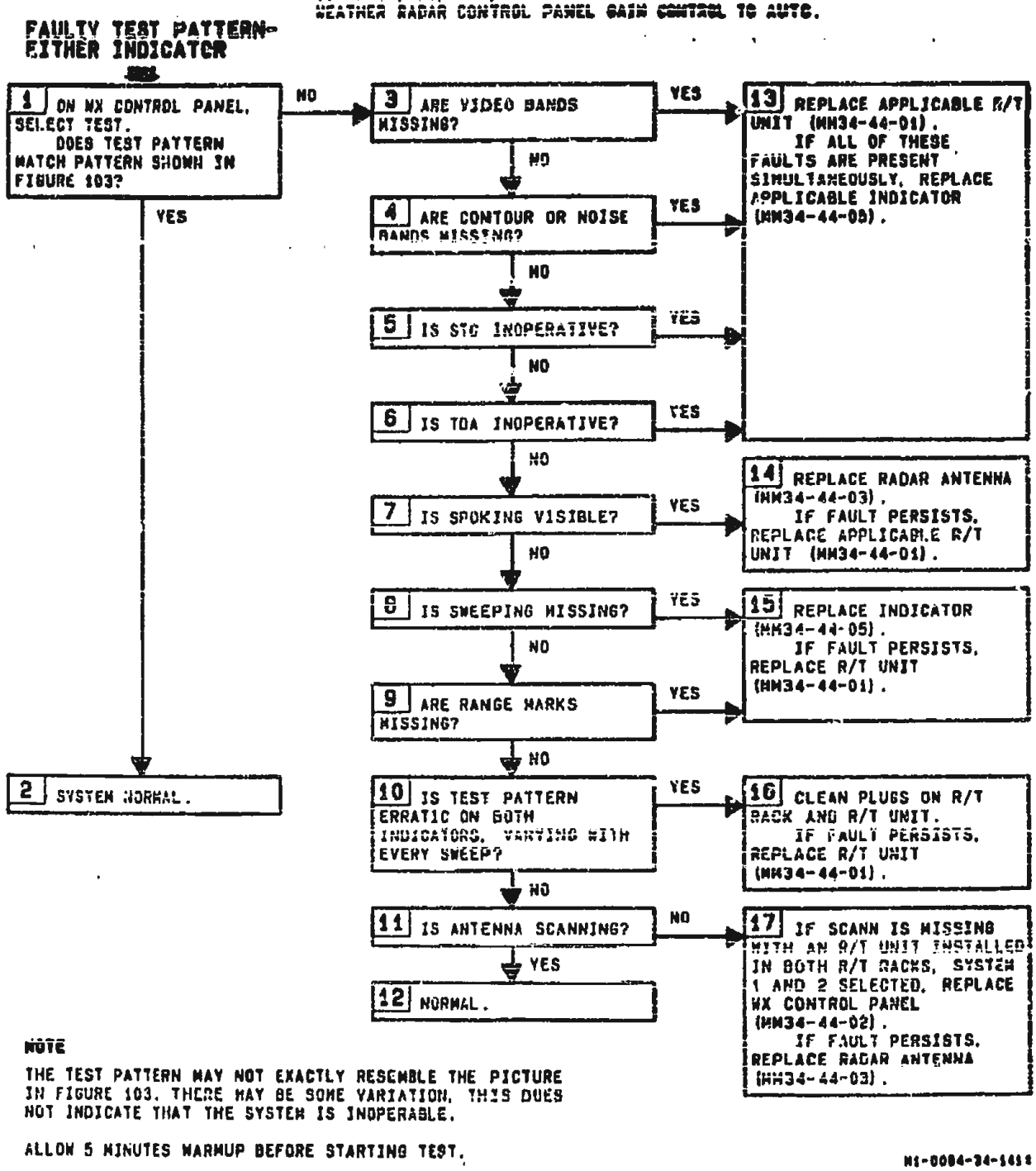
NOTE
ALLOW 5 MINUTES WARMUP BEFORE STARTING TEST

M1–3000–34–4224

R CONTOUR/MAP Mode(s) Inoperative
R Figure 106

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT.
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL GAIN CONTROL TO AUTO.


FAULTY TEST PATTERN-EITHER INDICATOR
1 ON WX CONTROL PANEL, SELECT TEST. DOES TEST PATTERN MATCH PATTERN SHOWN IN FIGURE 103?
NO
YES
2 SYSTEM NORMAL.
3 ARE VIDEO BANDS MISSING?
YES
NO
4 ARE CONTOUR OR NOISE BANDS MISSING?
YES
NO
5 IS STC INOPERATIVE?
YES
NO
6 IS TDA INOPERATIVE?
YES
NO
7 IS SPOKING VISIBLE?
YES
NO
8 IS SWEEPING MISSING?
YES
NO
9 ARE RANGE MARKS MISSING?
YES
NO
10 IS TEST PATTERN ERRATIC ON BOTH INDICATORS, VARYING WITH EVERY SWEEP?
YES
NO
11 IS ANTENNA SCANNING?
NO
YES
12 NORMAL.
13 REPLACE APPLICABLE R/T UNIT (MM34-44-01). IF ALL OF THESE FAULTS ARE PRESENT SIMULTANEOUSLY, REPLACE APPLICABLE INDICATOR (MM34-44-05).
14 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, REPLACE APPLICABLE R/T UNIT (MM34-44-01).
15 REPLACE INDICATOR (MM34-44-05). IF FAULT PERSISTS, REPLACE R/T UNIT (MM34-44-01).
16 CLEAN PLUGS ON R/T RACK AND R/T UNIT. IF FAULT PERSISTS, REPLACE R/T UNIT (MM34-44-01).
17 IF SCANN IS MISSING WITH AN R/T UNIT INSTALLED IN BOTH R/T RACKS, SYSTEM 1 AND 2 SELECTED, REPLACE WX CONTROL PANEL (MM34-44-02). IF FAULT PERSISTS, REPLACE RADAR ANTENNA (MM34-44-03).

NOTE

THE TEST PATTERN MAY NOT EXACTLY RESEMBLE THE PICTURE IN FIGURE 103. THERE MAY BE SOME VARIATION. THIS DOES NOT INDICATE THAT THE SYSTEM IS INOPERABLE.

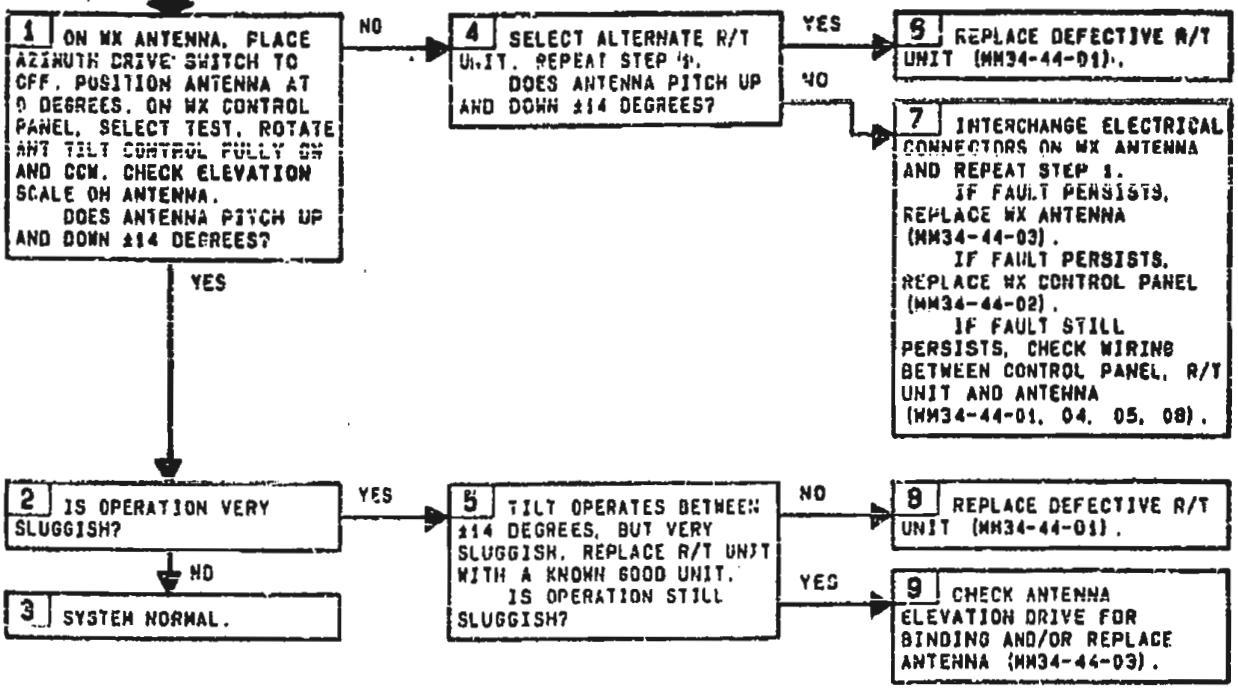
ALLOW 5 MINUTES WARMUP BEFORE STARTING TEST.

M1-0084-34-1414

R Faulty Test Pattern - Either Indicator
R Figure 107

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - LC FLO COOLING
LIGHTS ON FE/SD ECS MONITOR PANEL ARE OUT
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL
SYSTEM 1-2 SWITCH AS REQUIRED
RADOME OPEN: TWO MEN REQUIRED, ONE OUTSIDE TO OBSERVE
ANTENNA AND ONE IN FLIGHT STATION
ATTITUDE REFERENCE SYSTEM OPERATIONAL

TILT CONTROL HAS NO EFFECT ON TARGET RETURN - BOTH INDICATORS


1 ON WX ANTENNA, PLACE AZIMUTH DRIVE SWITCH TO OFF. POSITION ANTENNA AT 0 DEGREES. ON WX CONTROL PANEL, SELECT TEST, ROTATE ANT TILT CONTROL FULLY CW AND CCW. CHECK ELEVATION SCALE ON ANTENNA. DOES ANTENNA PITCH UP AND DOWN ±14 DEGREES?
NO
4 SELECT ALTERNATE R/T UNIT. REPEAT STEP 1. DOES ANTENNA PITCH UP AND DOWN ±14 DEGREES?
YES
6 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).
NO
7 INTERCHANGE ELECTRICAL CONNECTORS ON WX ANTENNA AND REPEAT STEP 1. IF FAULT PERSISTS, REPLACE WX ANTENNA (MM34-44-03). IF FAULT PERSISTS, REPLACE WX CONTROL PANEL (MM34-44-02). IF FAULT STILL PERSISTS, CHECK WIRING BETWEEN CONTROL PANEL, R/T UNIT AND ANTENNA (MM34-44-01, 04, 05, 08).
YES
2 IS OPERATION VERY SLUGGISH?
YES
5 TILT OPERATES BETWEEN ±14 DEGREES, BUT VERY SLUGGISH. REPLACE R/T UNIT WITH A KNOWN GOOD UNIT. IS OPERATION STILL SLUGGISH?
NO
8 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).
YES
9 CHECK ANTENNA ELEVATION DRIVE FOR BINDING AND/OR REPLACE ANTENNA (MM34-44-03).
NO
3 SYSTEM NORMAL.

NOTE

ALLOW 5 MINUTE WARMUP
AT TEST CONCLUSION PLACE AZIMUTH DRIVE CONTROL SWITCH ON ANTENNA TO ON.

M1-0003-34-2045

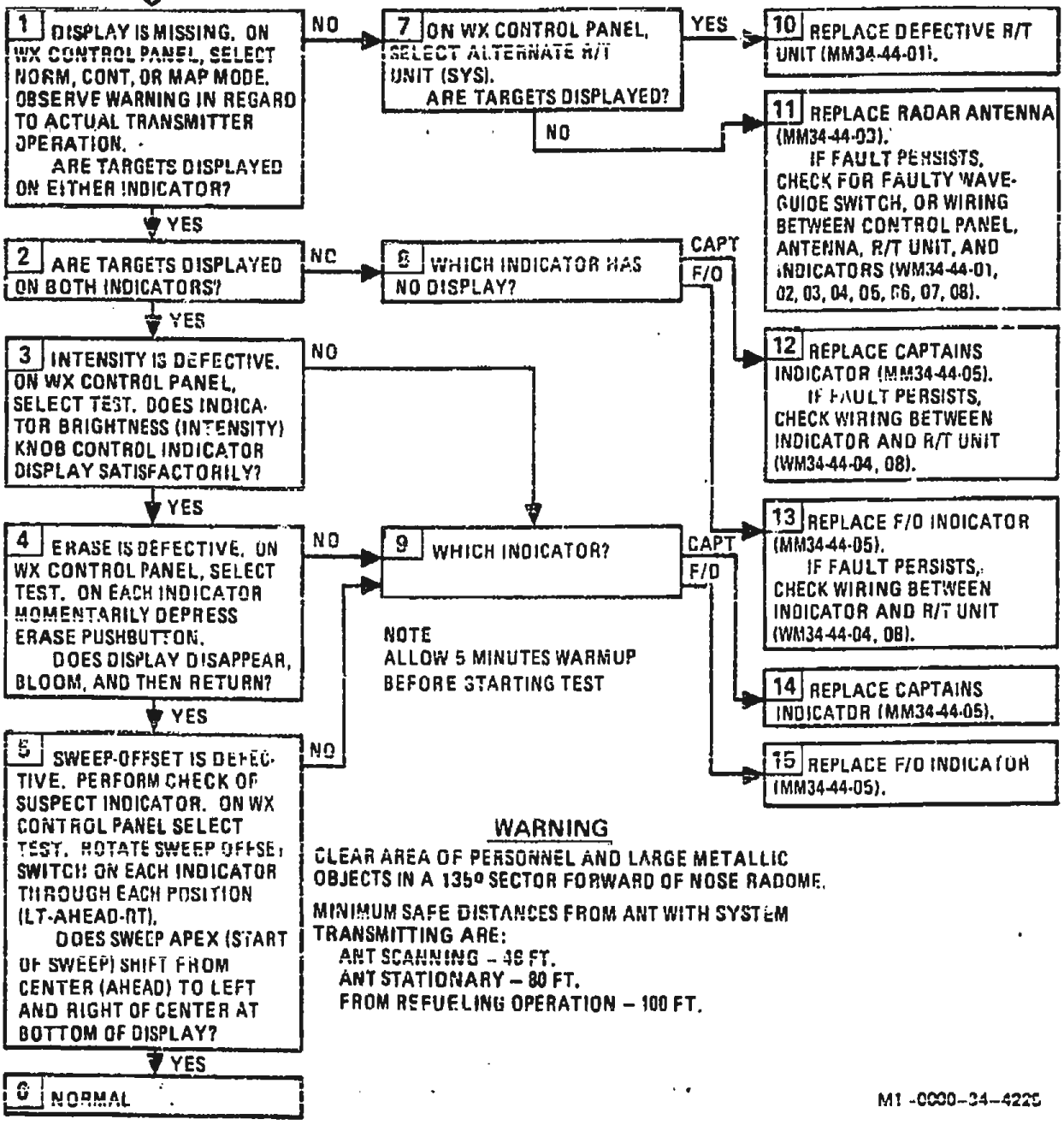
R
R

Antenna Tilt Fault
Figure 108

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR–LO FLO COOLING LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT.
CB'S: D2, D3, D20, D21
WEATHER RADAR CONTROL PANEL
SYSTEM 1-2 TO SYSTEM UNDER TEST.
GAIN CONTROL TO AUTO.
RADOME CLOSED, OBSERVE WARNING.
ATTITUDE REFERENCE SYSTEM OPERATIONAL.

ABNORMAL INDICATOR FAULTS


1 DISPLAY IS MISSING. ON WX CONTROL PANEL, SELECT NORM, CONT, OR MAP MODE. OBSERVE WARNING IN REGARD TO ACTUAL TRANSMITTER OPERATION. ARE TARGETS DISPLAYED ON EITHER INDICATOR?
NO
7 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT (SYS). ARE TARGETS DISPLAYED?
YES
10 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).
NO
11 REPLACE RADAR ANTENNA (MM34-44-03). IF FAULT PERSISTS, CHECK FOR FAULTY WAVE-GUIDE SWITCH, OR WIRING BETWEEN CONTROL PANEL, ANTENNA, R/T UNIT, AND INDICATORS (WM34-44-01, 02, 03, 04, 05, 06, 07, 08).
YES
2 ARE TARGETS DISPLAYED ON BOTH INDICATORS?
NO
8 WHICH INDICATOR HAS NO DISPLAY?
CAPT
F/O
12 REPLACE CAPTAINS INDICATOR (MM34-44-05). IF FAULT PERSISTS, CHECK WIRING BETWEEN INDICATOR AND R/T UNIT (WM34-44-04, 08).
YES
3 INTENSITY IS DEFECTIVE. ON WX CONTROL PANEL, SELECT TEST. DOES INDICATOR BRIGHTNESS (INTENSITY) KNOB CONTROL INDICATOR DISPLAY SATISFACTORILY?
NO
YES
4 ERASE IS DEFECTIVE. ON WX CONTROL PANEL, SELECT TEST. ON EACH INDICATOR MOMENTARILY DEPRESS ERASE PUSHBUTTON. DOES DISPLAY DISAPPEAR, BLOOM, AND THEN RETURN?
NO
9 WHICH INDICATOR?
CAPT
F/O
13 REPLACE F/O INDICATOR (MM34-44-05). IF FAULT PERSISTS, CHECK WIRING BETWEEN INDICATOR AND R/T UNIT (WM34-44-04, 08).
NOTE
ALLOW 5 MINUTES WARMUP BEFORE STARTING TEST
14 REPLACE CAPTAINS INDICATOR (MM34-44-05).
15 REPLACE F/O INDICATOR (MM34-44-05).
YES
5 SWEEP-OFFSET IS DEFECTIVE. PERFORM CHECK OF SUSPECT INDICATOR. ON WX CONTROL PANEL SELECT TEST. ROTATE SWEEP OFFSET SWITCH ON EACH INDICATOR THROUGH EACH POSITION (LT-AHEAD-RT). DOES SWEEP APEX (START OF SWEEP) SHIFT FROM CENTER (AHEAD) TO LEFT AND RIGHT OF CENTER AT BOTTOM OF DISPLAY?
NO
YES
6 NORMAL

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 46 FT.
ANT STATIONARY – 80 FT.
FROM REFUELING OPERATION – 100 FT.

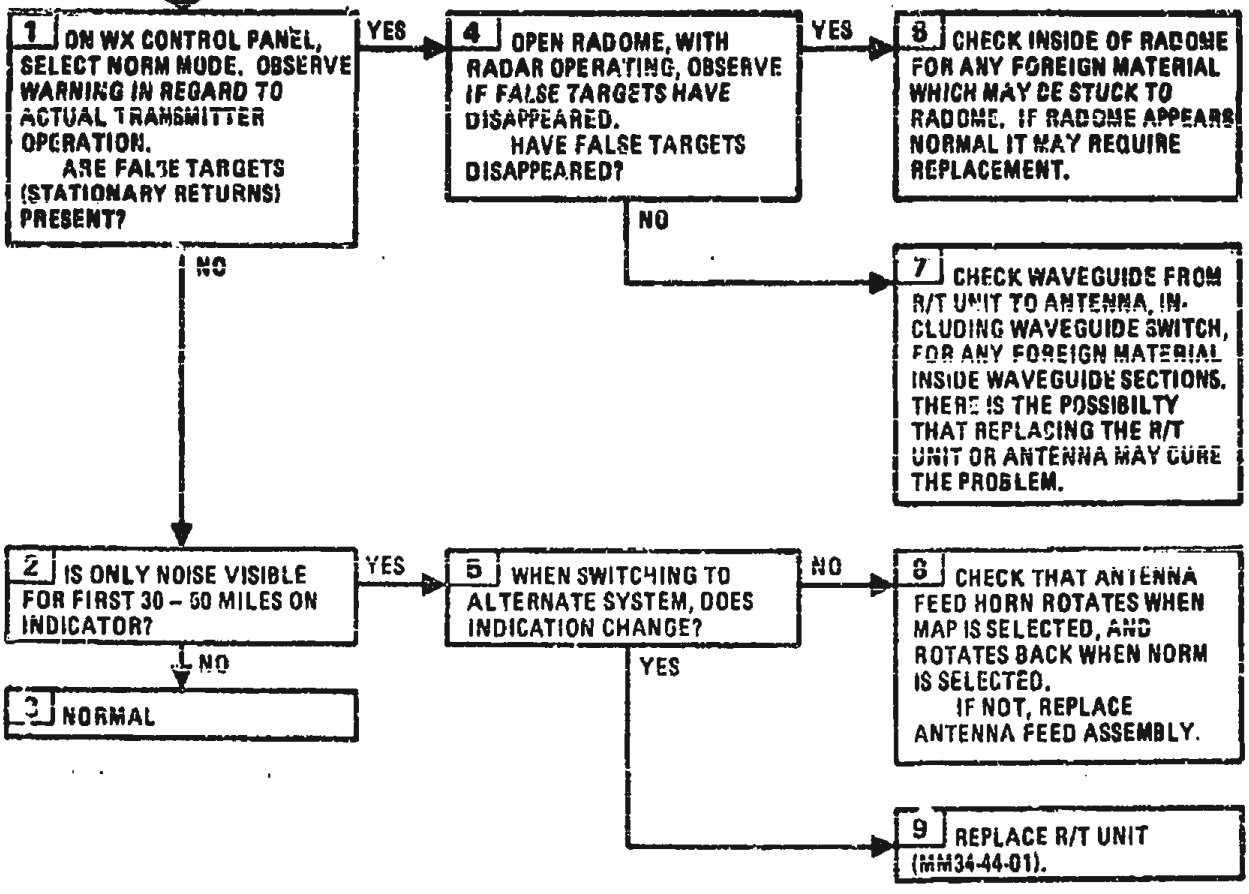
M1-0000-34-4225

R
R

Abnormal Indicator Faults
Figure 109

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR – LO FLO COOLING LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 1D2, 1D3, 1D29, 1D21
ATTITUDE REFERENCE SYSTEM OPERATIONAL.

FALSE TARGETS – BOTH INDICATORS


1 ON WX CONTROL PANEL, SELECT NORM MODE. OBSERVE WARNING IN REGARD TO ACTUAL TRANSMITTER OPERATION.
ARE FALSE TARGETS (STATIONARY RETURNS) PRESENT?
YES
NO
4 OPEN RADOME, WITH RADAR OPERATING, OBSERVE IF FALSE TARGETS HAVE DISAPPEARED.
HAVE FALSE TARGETS DISAPPEARED?
YES
NO
5 CHECK INSIDE OF RADOME FOR ANY FOREIGN MATERIAL WHICH MAY BE STUCK TO RADOME. IF RADOME APPEARS NORMAL IT MAY REQUIRE REPLACEMENT.
7 CHECK WAVEGUIDE FROM R/T UNIT TO ANTENNA, INCLUDING WAVEGUIDE SWITCH, FOR ANY FOREIGN MATERIAL INSIDE WAVEGUIDE SECTIONS. THERE IS THE POSSIBILTY THAT REPLACING THE R/T UNIT OR ANTENNA MAY CURE THE PROBLEM.
2 IS ONLY NOISE VISIBLE FOR FIRST 30 – 50 MILES ON INDICATOR?
YES
NO
3 NORMAL
5 WHEN SWITCHING TO ALTERNATE SYSTEM, DOES INDICATION CHANGE?
NO
YES
6 CHECK THAT ANTENNA FEED HORN ROTATES WHEN MAP IS SELECTED, AND ROTATES BACK WHEN NORM IS SELECTED.
IF NOT, REPLACE ANTENNA FEED ASSEMBLY.
9 REPLACE R/T UNIT (MM34-44-01).

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 46 FT.
ANT STATIONARY – 80 FT.
FROM REFUELING OPERATION – 100 FT.

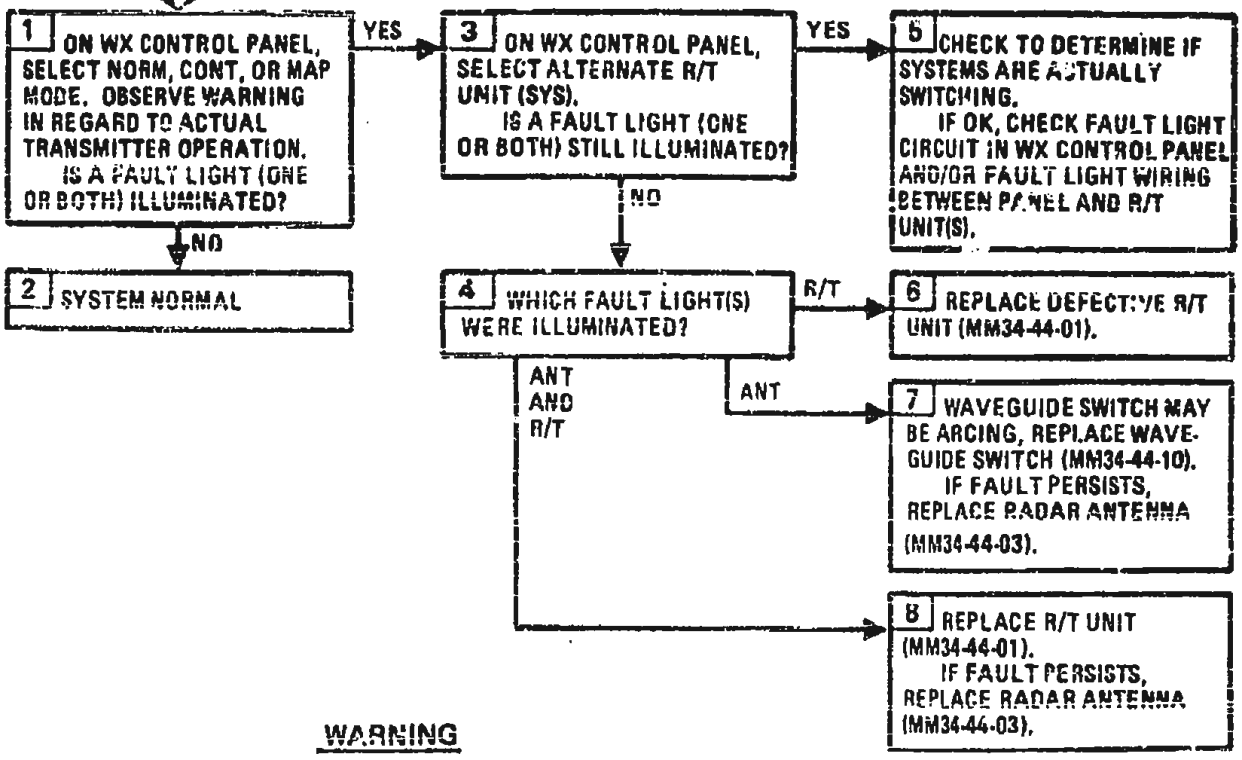
NOTE
ALLOW 5 MINUTES WARMUP BEFORE STARTING TEST

MJ-000-34-2020

R False Targets (Echoes)
R Figure 110

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR–LO FLO COOLING LIGHTS ON FE/SO ECS MONITOR PANEL ARE OUT.
CB'S: 1D2, 103, 1D20, 1D21
WEATHER RADAR CONTROL PANEL
SYSTEM 1-2 TO SYSTEM UNDER TEST.
GAIN CONTROL TO AUTO.
RADOME CLOSED, OBSERVE WARNING.
ATTITUDE REFERENCE SYSTEM OPERATIONAL.


FAULT LIGHT REPORTED ON – ONE OR BOTH
1 ON WX CONTROL PANEL, SELECT NORM, CONT, OR MAP MODE. OBSERVE WARNING IN REGARD TO ACTUAL TRANSMITTER OPERATION. IS A FAULT LIGHT (ONE OR BOTH) ILLUMINATED?
YES
NO
2 SYSTEM NORMAL
3 ON WX CONTROL PANEL, SELECT ALTERNATE R/T UNIT (SYS). IS A FAULT LIGHT (ONE OR BOTH) STILL ILLUMINATED?
YES
NO
5 CHECK TO DETERMINE IF SYSTEMS ARE ACTUALLY SWITCHING. IF OK, CHECK FAULT LIGHT CIRCUIT IN WX CONTROL PANEL AND/OR FAULT LIGHT WIRING BETWEEN PANEL AND R/T UNIT(S).
4 WHICH FAULT LIGHT(S) WERE ILLUMINATED?
R/T
6 REPLACE DEFECTIVE R/T UNIT (MM34-44-01).
ANT AND R/T
ANT
7 WAVEGUIDE SWITCH MAY BE ARCING, REPLACE WAVEGUIDE SWITCH (MM34-44-10). IF FAULT PERSISTS, REPLACE RADAR ANTENNA (MM34-44-03).
8 REPLACE R/T UNIT (MM34-44-01). IF FAULT PERSISTS, REPLACE RADAR ANTENNA (MM34-44-03).

WARNING

CLEAR AREA OF PERSONNEL AND LARGE METALLIC OBJECTS IN A 135° SECTOR FORWARD OF NOSE RADOME.

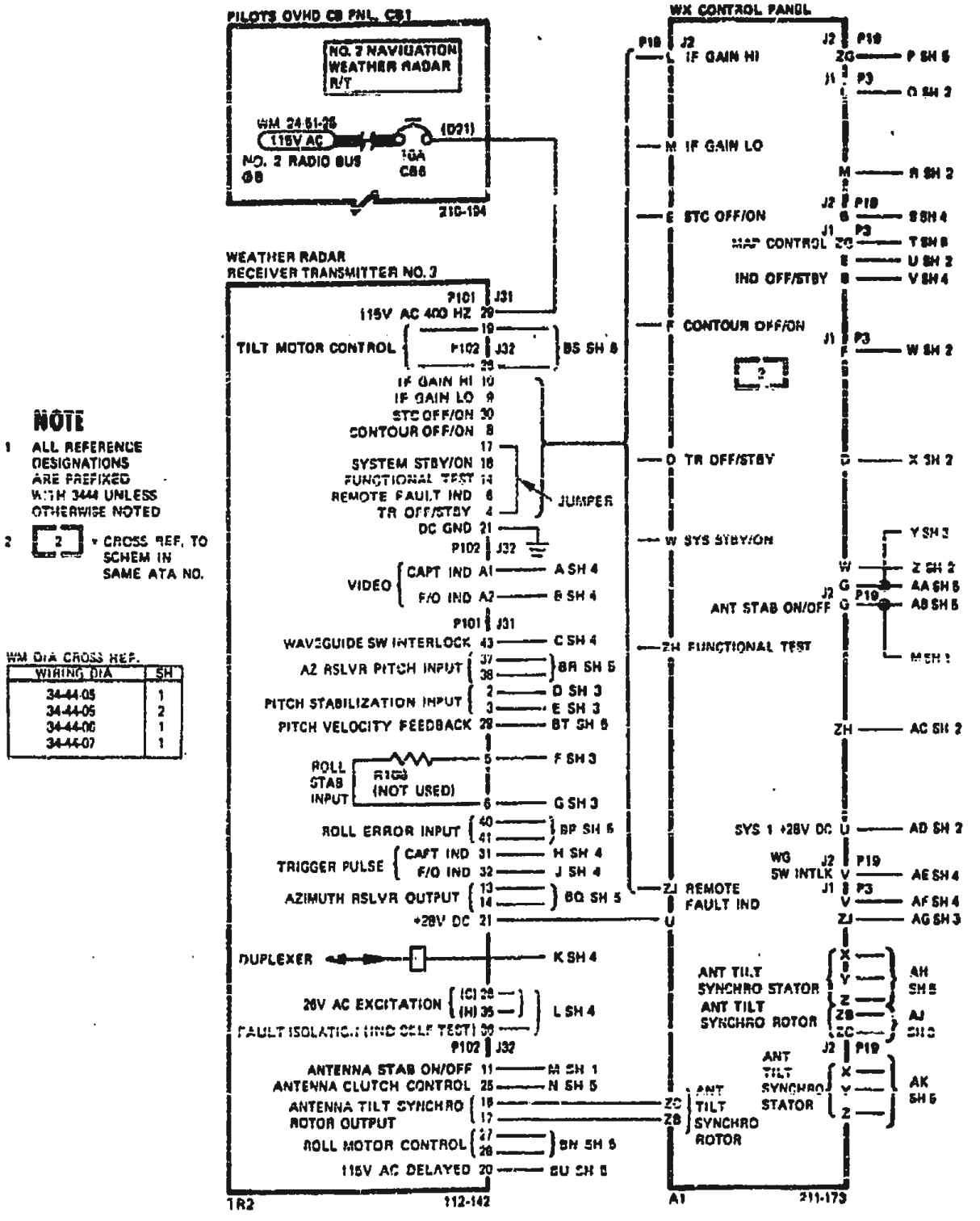
MINIMUM SAFE DISTANCES FROM ANT WITH SYSTEM TRANSMITTING ARE:
ANT SCANNING – 46 FT.
ANT STATIONARY – 80 FT.
FROM REFUELING OPERATION – 100 FT.

NOTE

FAULT LAMPS ON, INDICATE THAT A CIRCUIT HAS DEVIATED FROM PRESET LEVELS. THIS DOES NOT NECESSARILY MEAN THAT THE SYSTEM IS INOPERABLE AS A RADAR. OPTIMUM PERFORMANCE IS DETERMINED BY THE DISPLAY ON THE INDICATOR. ALLOW 5 MINUTES WARMUP BEFORE STARTING TEST

M1–0005–34–2028

R R Fault Light Reported On - One or Both
Figure 111


PILOTS OVHD CB PNL, CB1
NO. 2 NAVIGATION WEATHER RADAR R/T
WM 24-51-26
115V AC
(D21)
10A
CB6
NO. 2 RADIO BUS
210-194
WEATHER RADAR RECEIVER TRANSMITTER NO. 2
P101 J31
115V AC 400 HZ 29
19
TILT MOTOR CONTROL P102 J32 29 BS SH 5
IF GAIN HI 10
IF GAIN LO 9
STC OFF/ON 30
CONTOUR OFF/ON 8
17
SYSTEM STBY/ON 16
FUNCTIONAL TEST 14
REMOTE FAULT IND 6
TR OFF/STBY 4
JUMPER
DC GND 21
P102 J32
VIDEO CAPT IND A1 A SH 4
F/O IND A2 B SH 4
P101 J31
WAVEGUIDE SW INTERLOCK 43 C SH 4
A2 RSLVR PITCH INPUT 37 38 BR SH 5
PITCH STABILIZATION INPUT 2 D SH 3
3 E SH 3
PITCH VELOCITY FEEDBACK 28 BT SH 5
ROLL STAB INPUT R1(3) (NOT USED)
5 F SH 3
6 G SH 3
ROLL ERROR INPUT 40 41 BP SH 5
TRIGGER PULSE CAPT IND 31 H SH 4
F/O IND 32 J SH 4
AZIMUTH RSLVR OUTPUT 13 14 BQ SH 5
+28V DC 21
DUPLEXER K SH 4
26V AC EXCITATION (C) 28 (H) 35 L SH 4
FAULT ISOLATION (IND SELF TEST) 36
P102 J32
ANTENNA STAB ON/OFF 11 M SH 1
ANTENNA CLUTCH CONTROL 25 N SH 5
ANTENNA TILT SYNCHRO ROTOR OUTPUT 18 17 ZC ZB
ROLL MOTOR CONTROL 27 28 BN SH 5
115V AC DELAYED 20 BU SH 5
1R2
112-142
WX CONTROL PANEL
P18 J2
L IF GAIN HI
M IF GAIN LO
E STC OFF/ON
CONTOUR OFF/ON
O TR OFF/STBY
W SYS STBY/ON
ZH FUNCTIONAL TEST
ZJ REMOTE FAULT IND
U
J2 P19
ZG P SH 5
J1 P3
Q SH 2
M R SH 2
J2 P18
S SH 4
J1 P3
MAP CONTROL ZC T SH 5
E U SH 2
IND OFF/STBY B V SH 4
J1 P3
F W SH 2
D X SH 2
Y SH 2
W Z SH 2
G AA SH 5
J2 P19
ANT STAB ON/OFF G AB SH 5
M SH 1
ZH AC SH 2
SYS 1 +28V DC U AD SH 2
WG SW INTLK J2 P19 V AE SH 4
J1 P3
V AF SH 4
ZJ AG SH 3
ANT TILT SYNCHRO STATOR X Y Z AH SH 5
ANT TILT SYNCHRO ROTOR ZB ZC AJ SH 5
J2 P19
ANT TILT SYNCHRO STATOR X Y Z AK SH 5
ANT TILT SYNCHRO ROTOR ZC ZB
A1
211-173

NOTE

1. ALL REFERENCE DESIGNATIONS ARE PREFIXED WITH 3444 UNLESS OTHERWISE NOTED
2. [2] * CROSS REF. TO SCHEM IN SAME ATA NO.

WM DIA CROSS REF.

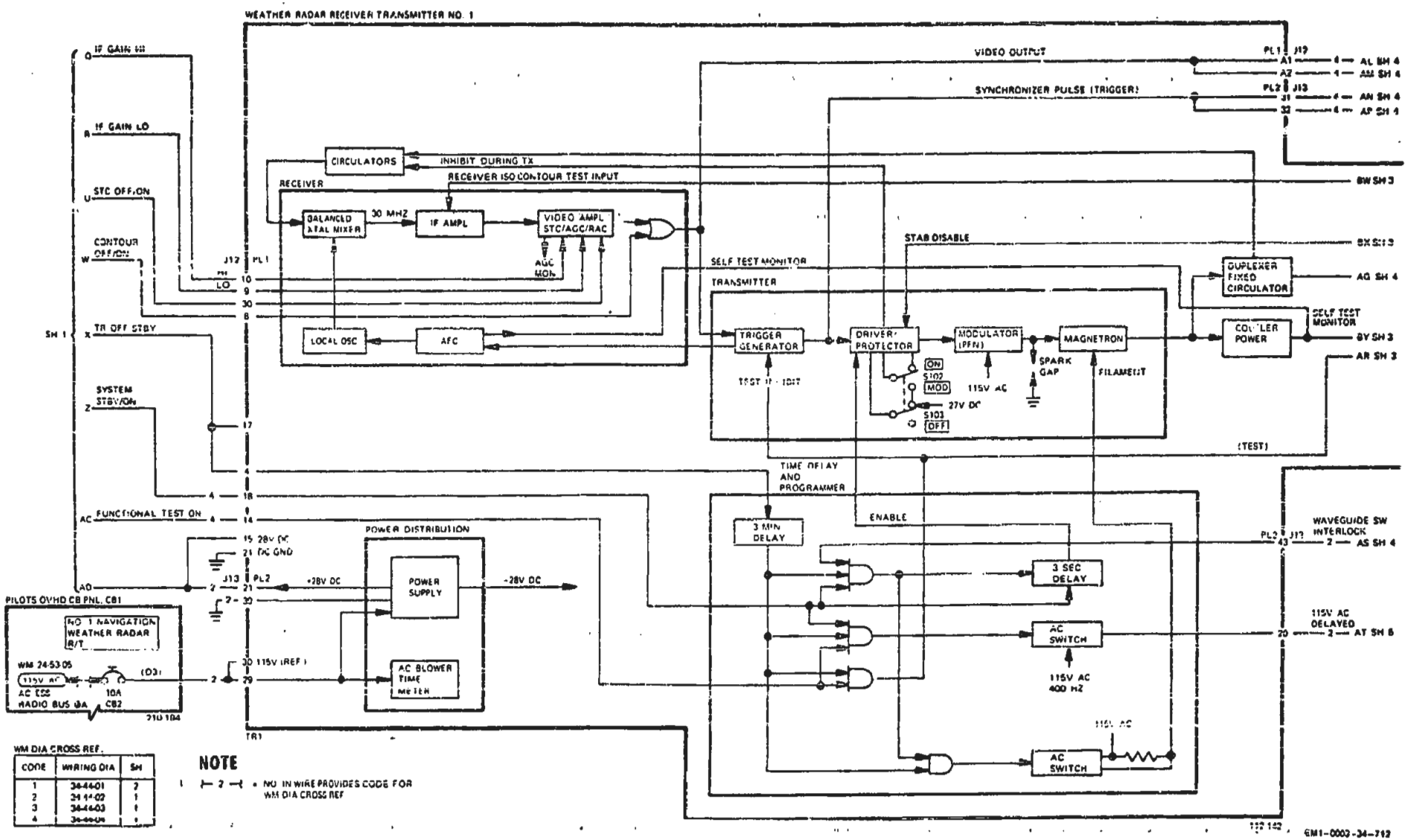
WIRING DIA	SH
34-44-05	1
34-44-05	2
34-44-06	1
34-44-07	1

EMI-0004-34-708

R Weather Radar System (R/T No. 2 and Cont Pnl) Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

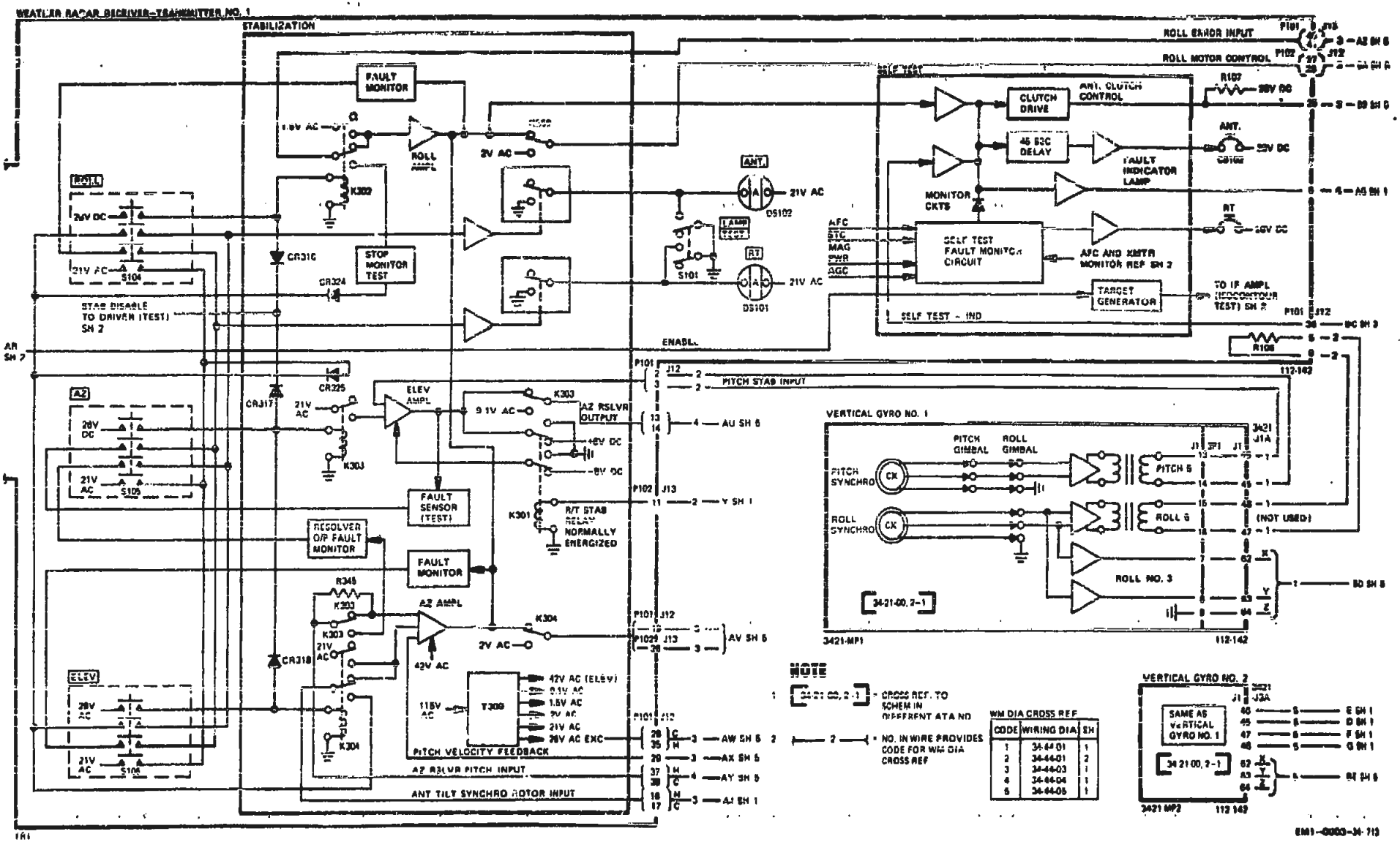
001B



R Weather Radar System (R/T No. 1) Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

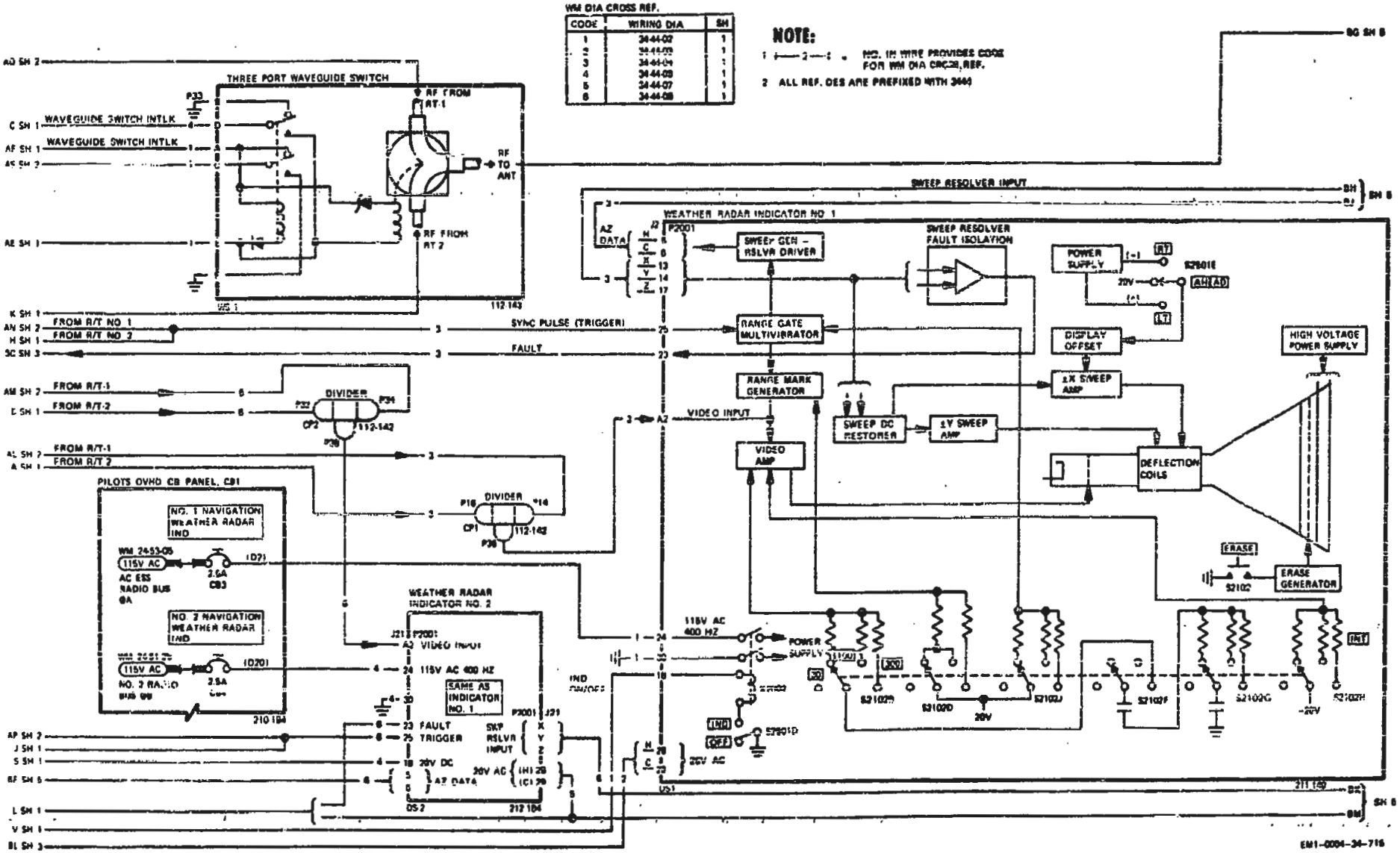
001B



Weather Radar System (T/R No. 1) Schematic
SCHEM 1 (Sheet 3)

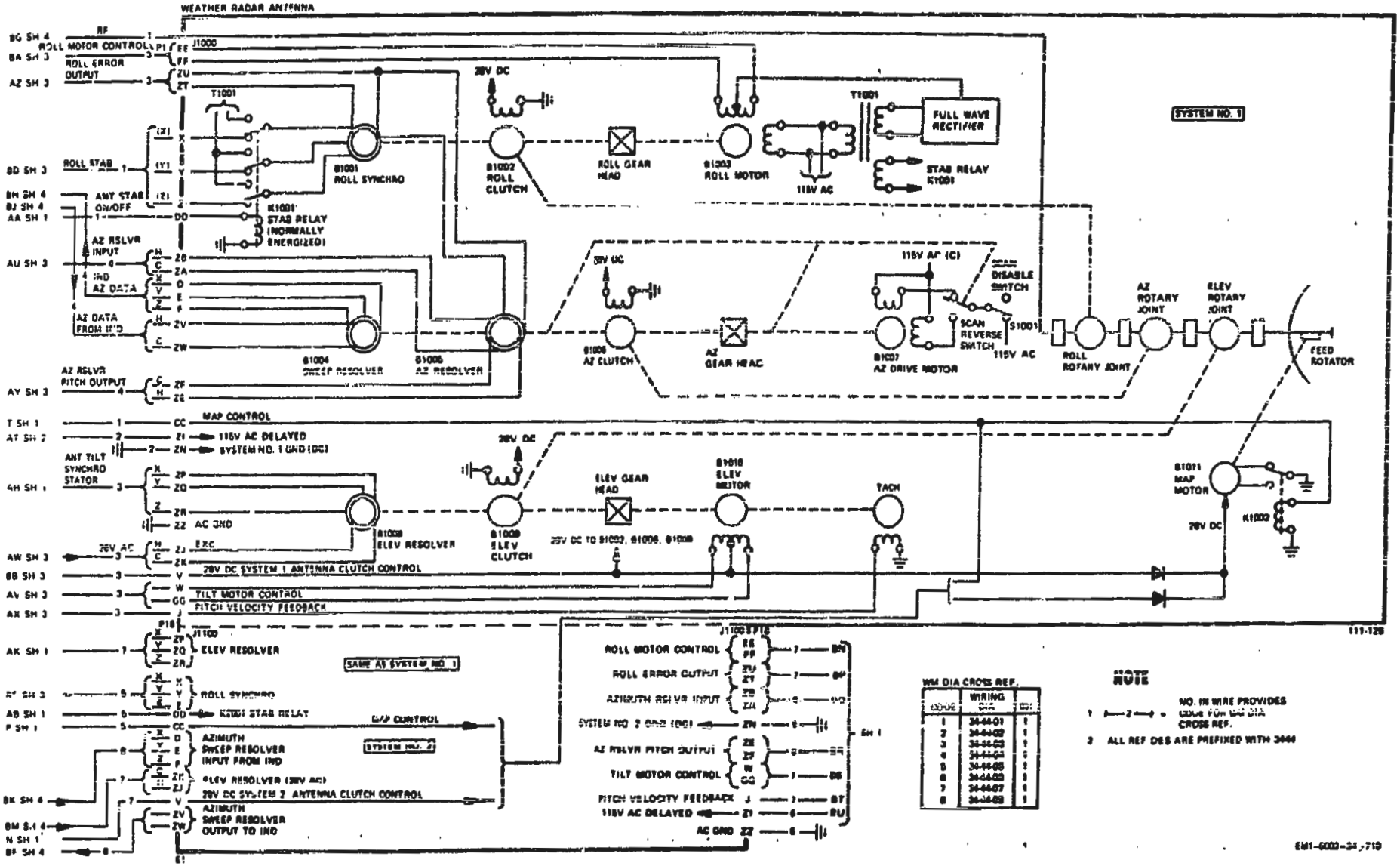
R
R
0019

EFFECTIVITY: ALL



R Weather Radar System (Indicator) Schematic
R SCHEM 1 (Sheet 4)

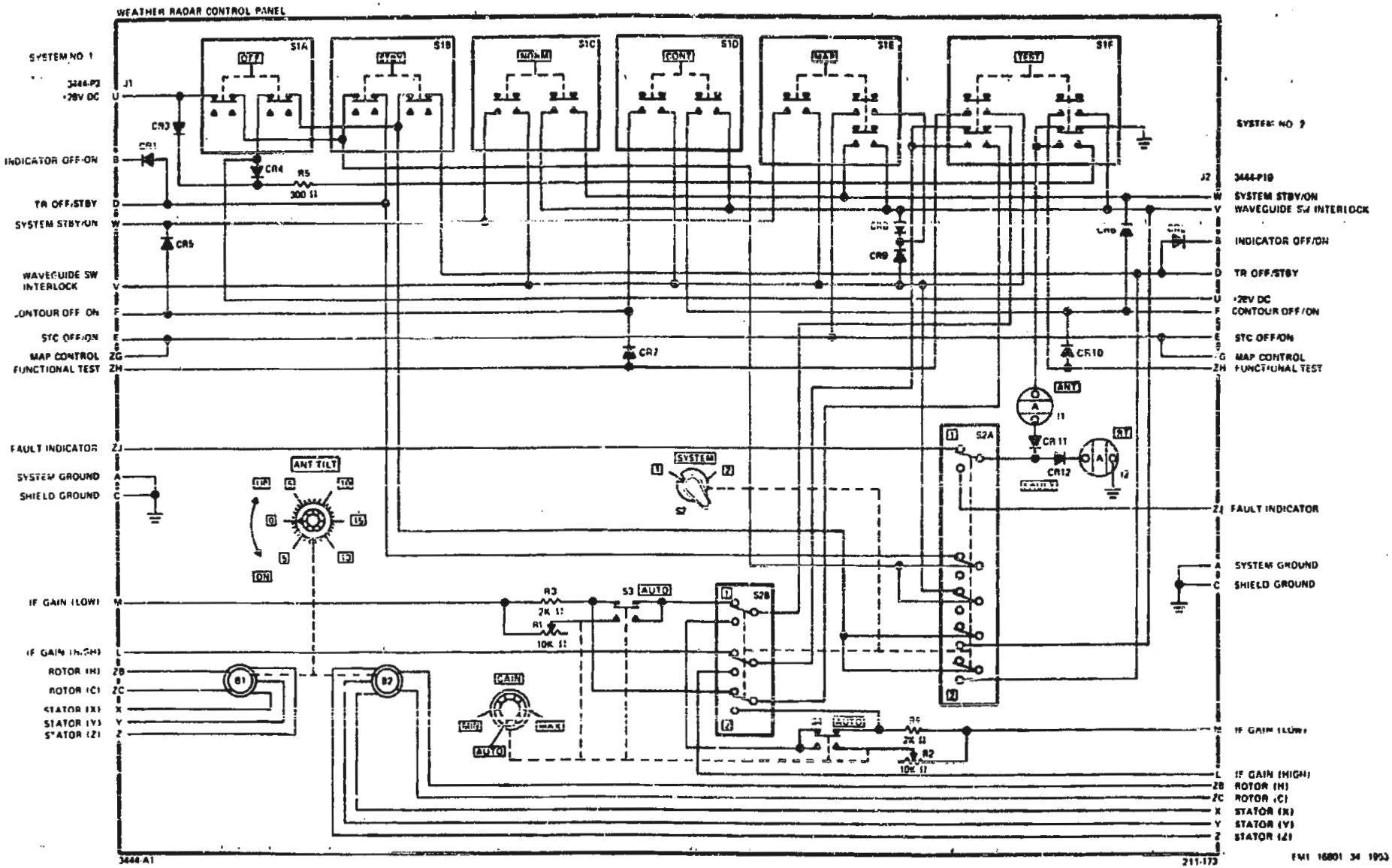
EFFECTIVITY: ALL



R Weather Radar System (Antenna) Schematic
R SCHEM 1 (Sheet 5)

EFFECTIVITY: ALL

0018



Weather Radar Control Panel Schematic
SCHEM 2

R
R
001B

EFFECTIVITY: ALL

WEATHER RADAR SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

21-20-00 Equipment Cooling - Maintenance Practices

24-00-00 Electrical Power System - Maintenance Practices

34-21-00 Attitude Reference System - Adjustment and Test

34-43-00 Inertial Navigation System - Adjustment and Test (aircraft with INS)

2. WEATHER RADAR - SAFEGUARDS AGAINST RADIATION HAZARDS

A. GENERAL

(1) SAFE DISTANCES

(a) There are two possible hazards that could result from weather radar ground operation.

- Biological effects.
- Possibility of fuel vapor explosion.

(b) The first is primarily due to heating of body tissues and is dependent on average power, the second is dependent on production of a spark and is therefore an effect controlled by peak power. There are no internationally accepted figures for the power density levels that produce these effects. The minimum safe distances can be calculated using FAA Advisory Circular AC20-68B, dated 8 August 1980. The figures in this procedure are Lockheed figures and are slightly higher than those obtained using the FAA Advisory Circular.

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(2) PRECAUTIONS

WARNING: TO SAFEGUARD BOTH PERSONNEL AND EQUIPMENT WHILE TESTS ARE BEING CARRIED OUT, THE FOLLOWING PRECAUTIONS MUST BE OBSERVED:

(a) Use appropriate radiation absorber whenever possible and ensure it is correctly installed before equipment is turned on.

(b) Do not allow radar to radiate while aircraft is hangered unless an absorber is installed, or aircraft is positioned nose out, with hangar doors open.

(c) Under normal radar operating conditions minimum safe distance is 46 feet.

(d) It is important that weather radar systems are not left operating in a radiating condition when unattended. If scanner fails while equipment is transmitting (i.e. display appears as a straight line) switch off immediately.

R (e) The radar beam must not be allowed to irradiate fuel trucks or other vehicles that are within 100 feet of the antenna.

C Distances quoted are equal to or in excess of these
C limits.

(f) Do not operate weather radar equipment while aircraft is being fueled or defueled.

(g) Do not operate weather radar equipment while personnel are working on it, or while waveguide is unterminated.

C (h) Deleted.

C 3. Operational/Test

C WARNING: BEFORE OPERATING/TESTING THE WEATHER RADAR SYSTEM
C OBSERVE THE PRECAUTIONS GIVEN IN 34-44-00 PAGE 101 -
C WEATHER RADAR FAULT ISOLATION.

A. Preparation

NOTE: This procedure shall be performed with radome in open position.

(1) Turn on electrical power (Ref. 24-00-00).

(2) On FE/SO ECS MONITOR panel, ensure that AVIONIC AIR-FWD and MID LO FLO lights are out (Ref. 21-20-00).

(3) Verify that Attitude Reference Systems are operative as evidenced by retraction of ATT flag in Captains and F/Os ADI (Ref. 34-21-00, 34-43-00).

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

NO. 1 NAVIGATION WEATHER RADAR

IND (D2)

RT (D3)

NO. 2 NAVIGATION WEATHER RADAR

IND (D20)

RT (D21)

(5) On weather radar control panel located in pilots center console, zone 210, set controls as follows:

FUNCTION switch OFF

GAIN selector switch to AUTO

SYSTEM-1-2 switch to 1

C TILT selector switch to 14° UP.

(6) On Captains and First Officers weather radar indicators located on Captains and First Officers instrument panels, zones 211 and 212, set controls as follows:

RANGE control to 100

INT control fully CCW

OFFSET selector to AHEAD

RANGE MARKS Control fully CCW

Polarizer filter fully left

(7) C C On receiver-transmitter (RT) unit in rear avionics rack, FESC; place ANT and RT annunciators to the ON position.

C B. Perform Operational Test

C (1) Complete Preparation (Para. A).

C C (2) Press control panel TEST switch and observe R/T and ANT fault lights on the control panel illuminate.

C NOTE: These lights remain ON as long as the TEST mode
C is selected.

C (3) After a warm-up period of approximately three minutes,
C rotate the indicator RANGE MARKS control until range
C marks appear.

C (4) Rotate the indicator INT control to obtain a test
C pattern. (See Figure 501).

C NOTE: The INT control should be adjusted so that the
C noise or "grass" (small specks of light
C resembling snow) is absent behind the 25 NM
C range mark, but appears and becomes
C progressively brighter reading outward to the
C iso-contour arc at 60 NM.

C (5) Observe a bright snowy band across the indicator
C between 25 and 60 NM.

C (6) Observe two bright solid bands between 70 and 100 NM,
C which indicate one test video target. Observe the dark
C (iso-contour) band between these bright bands.

C (7) At the control panel, place the TFR switch to 2.

C (8) Repeat steps (4) through (6) for system 2.

C (9) At control panel, select system 1 by placing TFR to 1.

C (10) Rotate indicator INT control fully counterclockwise.

C (11) Rotate RANGE MARKS to fully counterclockwise and set
C antenna TILT to 0 degrees.

C (12) At R/T number 1, press LAMP TEST switch and observe ANT
C and R/T lamps illuminate.

C (13) At R/T number 1, press ROLL STABILIZATION TEST SWITCH
C and hold.

C NOTE: When a stabilization test button is initially
C pressed and held for the test, the FAULT lamps
C may light steadily, intermittently or not at
C all. The pushbuttons should not be held
C depressed for more than 45 seconds; significant
C errors are introduced in the stabilization
C system at this time, and the annunciators on the
C R/T front panel may trip and indicate a fault
C condition.

C (14) Observe that R/T and ANT. fault lamps are extinguished
C after 10 seconds.

C (15) Release ROLL STABILIZATION TEST SWITCH.

C (16) Repeat Steps (13) through (15) for AZ.

C (17) Repeat Steps (13) through (15) for ELEV.

C (18) At the control panel, select system 2 by placing TFR to
C 2.

C (19) Repeat Steps (12) through (17) for R/T number 2.

C (20) Set offset to LT position. Observe that apex of
C display shifts to right.

C (21) Set offset to RT position. Observe that apex of
C display shifts to left.

C (22) Set offset to AHEAD position. Observe display is
C symmetrical about the center of indicator.

C (23) At control panel, press OFF switch.

C (24) Remove electrical power if no longer required.

C 4. Adjustment/Test

C A. Complete Preparation (Ref. Para. 3.A.)

B. Preliminary Checks

WARNING: OBSERVE PRECAUTIONS CONCERNING RADAR TRANSMISSIONS.

(1) On weather radar control panel, operate controls as follows:

(a) Depress STBY pushbutton; verify that STBY legend comes on. Wait 3-1/2 minutes and perform next step.

(b) Depress TEST pushbutton; verify that TEST legend comes on. Verify that ANT and RT FAULT lamps are illuminated and antenna begins scanning.

CR (c) Deleted

C. Display Indicator Operation

(1) On Captains and First Officers weather radar indicators, adjust controls as follows:

(a) Adjust intensity control on both indicators until a comfortable intensity level is attained. All subsequent tests should be verified on both indicators.

(b) Check that indicator sweep is scanning smoothly between 90 degrees left and 90 degrees right of azimuth zero 8 ±2 scans per minute (verify that both indicators are synchronized). One scan is defined as a complete sequence of antenna rotation in both left and right directions. Verify sweep origin point at proper location.

(c) On antenna, set azimuth drive motor switch to OFF position. Rotate azimuth axis by hand until it is lined up in zero degree position.

(d) Verify that sweep line on indicator is within ±2 degrees of zero degree mark on indicator face. Adjust intensity control level as required, but keep near minimum to avoid burning tube face when antenna is not scanning.

(e) Place azimuth drive motor switch to ON position.

(f) Reset intensity control for best test pattern display. Observe that test bands do not overwrite (bloom) on edges of tube during scan change of direction.

(g) Rotate (Ref. Fig. 501) intensity control clockwise until test pattern appears. Adjust intensity control so that noise (small specks of light resembling snow) is absent behind 25 nm range mark, but then appears and becomes progressively brighter to iso-contour arc at 60 nm.

NOTE: The test pattern will appear on all three ranges, however, it will resemble Figure 501 only when 100 nm range is selected.

(h) Check offset sweep origin function by placing OFFSET selector switch to RT position. The sweep origin point should move to the left and display should coincide with test pattern.

(i) Place OFFSET selector switch to LT. The sweep origin point should move to the right. Return OFFSET selector switch to AHEAD.

(j) Check operation of polarization filter, full left no filtration, full right maximum filtration.

D. Antenna Radiation and Range Marks Check

(1) On weather radar control panel, operate controls as follows:

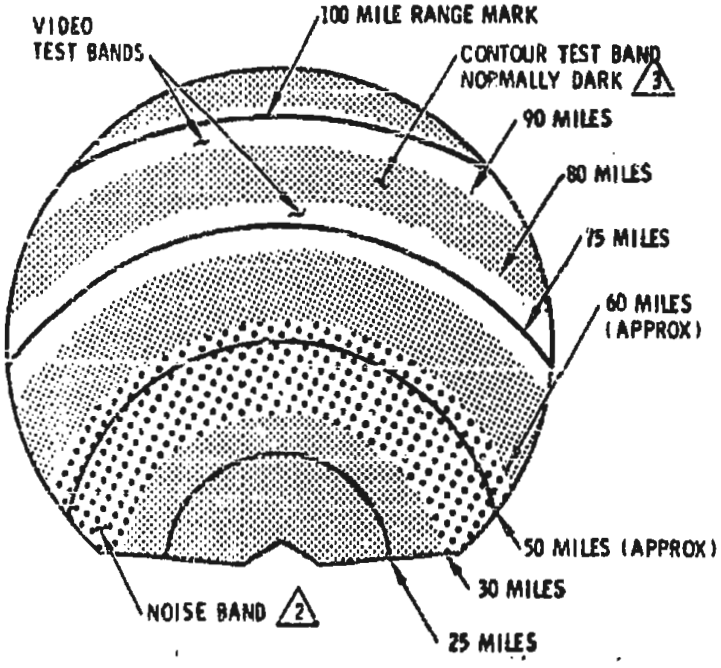
CAUTION: CLOSE RADOME AND OBSERVE PRECAUTIONS CONCERNING RADAR TRANSMISSIONS.

(a) Select NORM mode.

(b) Check that 4 range marks appear and are reasonably well defined. The outer range mark should be within 3/8 inch from top of screen and may be of less intensity than inner range marks.

(c) Rotate RANGE and MARKS switch to 300 miles position and depress erase button. Verify that display erases previous range marks and check that 6 range marks appear on display.

(d) Rotate RANGE and MARKS switch to 30 miles position and depress erase button. Verify that display



NOTE

1 TEST PATTERN IS SHOWN USING THE 100NM RANGE

2 NOISE CAN INCREASE FROM 30 MILES DOWN TOWARD 0 MILES. RADAR IS STILL USABLE, BUT STC HAS DETERIORATED

3 CONTOUR TEST BAND MAY INCREASE IN WIDTH. RADAR IS STILL USABLE BUT CONTOUR LEVEL IS LOWER THAN NORMAL

MI-0001-34-292

Weather Radar Test Pattern
Figure 501

erases previous range marks and check that 1 range marks appear on display.

(e) Check that targets appear on indicator display.

(f) Select CONT mode.

(g) Check that targets appear on indicator display.

(h) Select MAP mode.

(i) Check that targets appear on indicator display.

(j) Return RANGE & MARKS switch to 100 mile range.

(k) Select TEST mode.

(l) Verify radome is open.

E. Test Pattern Check (Self-Test)

NOTE: Observe that test pattern parameters on both INDICATORS (if applicable) meet criteria below. (See Figure 501).

(1) A band of noise (snow) shall be pulsed on during first 60 miles of sweep and inhibited at all other times. (Receiver operating normally.)

(2) The brightness of noise signal should increase gradually from a very low level at short ranges to a high level at 60 miles. (This indicates SENSITIVITY-TIME-CONTROL (STC) circuit is operational.)

(3) Two bright bands approximately 10 miles in length should be located between 70 and 80 mile range marks and 90 and 100 mile range marks respectively.

(4) The video test band signal should be separated by a dark (ISO-CONTOURED) central area.

F. Antenna Tilt Control Test

(1) On control panel, adjust ANT TILT control to 0 degrees.

(2) Place control panel FUNCTION switch to TEST.

(3) Set antenna azimuth drive motor switch (AZ) to OFF position. Position antenna manually to zero degrees azimuth.

(4) The antenna position in the elevation axis should be 0° ±0.5 degrees as read from elevation scale on antenna. WHEN THE ANTENNA IS NOT SCANNING, REDUCE DISPLAY INTENSITY TO AVOID BURNING THE SCREEN.

(5) Set ANT TILT control on control panel to 10 degrees DN. The antenna position shall be 10 ±0.5 degrees. Return ANT TILT to zero degree position.

R G. Antenna Stabilization Test (With VGs Installed)

(1) In FESC, forward rack:

Release three captive screws securing VG-1 to mount (Ref. 34-21-04).

Carefully lift VG-1 cut of mount and put in a pitch-up attitude (electrical connector downward).

RESULT: Weather radar indicators and Captains ADI display pitch-up (climb) attitude.

NOTE: If difficulty is encountered in determining pitch-up attitude on weather radar indicator display, proceed as follows:

Set VG-1 back in mount, rotate antenna tilt control downward (CCW) until a prominent target is displayed, rotate antenna tilt control slowly CW until target just disappears. Lift VG-1 out of mount and put in a pitch-up attitude. This will cause antenna to pitch down and target will reappear on indicators.

(2) In FESC, forward rack; put VG-1 in a pitch-down attitude (electrical connector upward).

RESULT: Weather radar indicators and Captains ADI display pitch-down (dive) attitude.

NOTE: If difficulty is encountered in determining pitch-down attitude on weather radar indicator display, proceed as follows: Set VG-1 back in mount, rotate antenna tilt control (either CW or CCW) until a prominent target is displayed. Lift VG-1 out of mount and put in a pitch-down attitude. This will cause antenna to pitch-up and target will disappear.

(3) In FESC, forward rack; put VG-1 in a right-roll attitude (fault annunciator/latitude switch side-up).

RESULT: Weather radar indicators and Captains ADI display right-roll attitude.

NOTE: If difficulty is encountered in determining right-roll attitude on weather radar indicator display, proceed as follows:

Set VG-1 back in mount, rotate antenna tilt control until a prominent target is displayed in right-hand sector of the PPI display. Lift VG-1 out of mount and put in a right-roll attitude. This will cause antenna sector scan to roll-left, previously displayed prominent target will either disappear or decrease in size and intensity, depending on range.

(4) In FESC, forward rack; put VG-1 in a left-roll attitude (fault annunciator/latitude switch side-down).

RESULT: Weather radar indicators and Captains ADI display left-roll attitude.

NOTE: If difficulty is encountered in determining left-roll attitude on weather radar indicator display, proceed as follows:

Set VG-1 back in mount, rotate antenna tilt control until a prominent target is displayed in left-hand sector of PPI display. Lift VG-1 out of mount and put in a left-roll attitude. This will cause antenna sector scan to roll-right, previously displayed prominent target will either disappear or decrease in size and intensity depending on range.

(5) In FESC, forward rack, install and secure VG-1 in mount (Ref. 34-21-04).

(6) If weather radar RT unit No. 2 is installed; on weather radar control panel, set SYSTEM 1-2 switch to 2. Repeat Steps 3A(5) thru 3B(24) and 4A thru 4G(5). In Steps 3G(1) thru 3g(5), substitude VG-2 for VG-1 and First Officers ADI for Captains ADI. Results shall be as specified.

R G. Antenna Stabilization Test (With Inertials Installed)

R NOTE: Go to 34-21-00, Maintenance Practices, Steps 2 thru
R 5B(14).

H. Test Completion

(1) On both weather radar indicators, rotate BRIGHTNESS control full CCW.

(2) On weather radar control panel, set SYSTEM 1-2 switch to 1, and depress OFF pushbutton switch, verify OFF legend comes on.

NOTE: Inertial batteries will discharge upon power removal if inertial systems are not set to OFF.

(3) Turn off aircraft electrical power.

(4) If no further maintenance is to be performed in FESC, close and secure access door 112AB.

CR 5. DETAILED CHECK OF L1011 WEATHER RADAR AVQ-30 SYSTEM

CR A. General

CR (1) This is a detailed check of the L1011 AVQ-30 weather CR radar system. These checks should be performed to CR detect and eliminate faults which are not detected by CR normal troubleshooting or routine maintenance tasks.

CR B. Waveguide Check

CR (1) Check waveguide for dents or deformities along its full CR length. Replace any sections exhibiting any of these CR deficiencies.

CR (2) Check for a flush fit at all waveguide joints: Check CR that fasteners are secure and there is no evidence of CR corrosion or arcing. Replace any section which does CR not meet these criteria.

CR (3) Disconnect the antenna, remove the R/T unit, and check CR for moisture at the antenna and R/T ends of the CR waveguide. Also check for moisture at the CR reflectometer. If any moisture is present, the CR waveguide must be dried out. Disassemble the waveguide CR to remove excessive moisture. To remove small amounts CR of moisture, which do not warrant disassembling the CR waveguide, disconnect the waveguide switch and pressure CR window and blow nitrogen through the remaining sections CR of waveguide.

CR C. R/T and Indicator Rack Connector Checks

CR (1) Check that the R/T and indicator unit rack connector CR bodies are not cracked or deformed. Check that inserts CR are not chipped or cracked.

CR (2) Check that brackets to which the connectors are
CR attached are vertical with respect to the unit tray and
CR that there is no angular misalignment of the
CR connectors.

CR (3) Perform a pin check of th R/T and indicator unit rack
CR connectors. Check that the coaxial pins are not worn,
CR bent, or pushed back.

CR (a) Pin checks are accomplished by inserting a male
CR pin of the proper size in female pins or by using
CR a female pin with proper size hole to check male
CR pins. Pin hole sizes are as follows:

CR 24 ga = .0245"
CR 23 ga = .0260"

CR 22 ga = .0290"

CR 20 ga = .0390"

CR 16 ga = .0615"

CR (b) Pin fit can only be determined by feel. Check for
CR a depth of 1/4 inch. This is the contact depth.
CR The test pin should have a slight drag when
CR inserting or withdrawing directly in line with the
CR connector pin being tested.

CR (4) Visually check that wires are firmly attached to the
CR connector pins.

CR (5) Properly connect wiring or coaxial cable connections if
CR discrepancies are found in steps 3 or 4. Replace
CR defective connectors and/or loose, worn, or deformed
CR pins.

CR D. Check Unit Mounts

CR (1) Check each R/T and indicator mount to assure that no
CR warpage exists and there are no cracks or breaks in the
CR assembly.

CR (2) Replace any hold-downs or extractors that are stripped
CR or bent.

CR E. Check Coaxial Video Cables

CR (1) Check coaxial cables using RR 90189 tester.

CR NOTE: Reference L1011 WD 34-44-04 page 1 sheet 1,
CR 34-44-08 page 1 sheet 1 for coax connections.

CR Reference L1011 MM 23-09-00 for coax tester
CR instructions.

CR (a) Remove No. 1 and No. 2 R/Ts and the No. 1 and No.
CR 2 indicators from the racks. Locate the two coax
CR "T" fittings, one mounted behind the left R/T
CR rack, and one mounted behind the right R/T rack.

CR (b) Connect coax tester to conn. P-36 of left "T"
CR fitting, and connect a 50 ohm load to pin A2 conn.
CR J2 of No. 1 indicator.

CR (c) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (d) Remove tester from conn. P36 and connect to conn.
CR P14 of the left "T" fitting, also remove 50 ohm
CR load from A2 conn. J2 of indicator, and connect
CR load to pin A1 conn. J12 of No. 1 R/T.

CR (e) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (f) Remove tester from conn. P14 and connect to conn.
CR P16 of the left "T" fitting, also remove 50 ohm
CR load from A1 conn. J12 of No. 1 R/T, and connect
CR load to pin A1 conn. J32 of No. 2 R/T.

CR (g) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (h) Remove tester from conn. P16 and connect to conn.
CR P34 of the right "T" fitting, also remove 50 ohm
CR load from A1 conn. J32 of No. 2 R/T, and connect
CR load to pin A2 conn. J12 of No. 1 R/T.

CR (i) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (j) Remove tester from conn. P34 and connect to conn.
CR P38 og the right "T" fitting, also remove 50 ohm
CR load from A2 conn. J12 of No. 1 R/T, and connect
CR load to pin A2 conn. J21 of No. 2 indicator.

CR (k) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (l) Remove tester from conn. P38 and connect to conn.
CR P32 of the right "T" fitting, also remove 50 ohm
CR load from A2 conn. J21 of No. 2 indicator, and
CR connect load to pin A2 conn. J32 of No. 2 R/T.

CR (m) Check display or paper printout for any signs of
CR serious deterioration or breakage of coax cable.

CR (n) Reconnect connectors removed on step E.

CR (2) Replace any coaxial cables found to be defective.

CR F. Check Unit to Rack Connector Engagement

CR (1) Conduct a tissue paper test (see below) of the R/T and
CR indicator unit rack connectors. If full engagement is
CR not attained make adjustments or remove obstructions as
CR required to correct the problem.

CR (a) The tissue paper check is accomplished by placing
CR tissue paper over the male connector pins and
CR punching the paper over each pin to perforate the
CR tissue. Then carefully engage the connector(s).
CR Removal of the mating connector(s) leaves the
CR tissue paper at the point of maximum engagement.
CR Measure the depth of engagement on the male pins.
CR The depth of engagement should not be less than
CR 1/4 inch. Remove the tissue paper residue after
CR this check.

CR G. Check R/T and Waveguide Connection

CR (1) Install R/T unit and seat it fully into the rack.

CR (2) Check that waveguide connection is properly centered
CR and fits flush with the R/T output flange. Make
CR adjustments to correct any misfit conditions.

CR H. Antenna Check

CR (1) Check that the reflector dish is smoothly concave and
CR that there are no dents of warpage of dish.

CR (2) Replace reflector dish if required.

CR (3) Check that the antenna feed is not cracked or parted at
CR the seam. There shall be no corrosion or dents in the
CR waveguide portion of the feed and it shall not be
CR warped, misfitted, or corroded at the antenna junction.

CR (4) Replace antenna feed as required.

CR (5) Check both antenna connectors for corrosion, cracks, or
CR any deformities. Replace defective connectors.

CR (6) Accomplish pin check of each contact. Replace
CR defective pins as required.

CR (7) Visually check for frayed wires, shorts, or foreign
CR material in the connector. Repair wiring and remove
CR foreign material as necessary.

CR I. Control Panel Check.

CR (1) Check both control panel connectors for corrosion,
CR cracks, and deformities. Replace defective connectors.

CR (2) Accomplish check of each contact. Replace defective
CR pins as required.

CR (3) Visually check for frayed wires, shorts, or foreign
CR material in the connector. Repair wiring and remove
CR foreign material.

CR J. Reactivate System

CR (1) Install all units, connect the antenna and control
CR panel connectors. Secure all R/Ts and indicators in
CR racks.

CR (a) Make certain that all tissue paper is removed from
CR the R/T and indicator connectors before installing
CR units.

CR (2) Secure all waveguide connections.

CR (3) Activate the system and conduct an adjustment/test of
CR the Weather Radar System. Replace any malfunctioning
CR units detected in this test.

CR (4) End of test. Switch radar to off position.

WEATHER RADAR RECEIVER-TRANSMITTER - REMOVAL AND INSTALLATION

1. Referenced Procedure

34-44-00 Weather Radar System - Adjustment and Test

2. Equipment and Materials

Waveguide Protective Cover, Part No. 1591482, or Technical Plastic Corp., Part No. 020-108

Electrical Connector Protective Cover, ITT Cannon Electric, Part No. 025-0585-000

3. Removal/Installation

A. Removal

(1) R On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

NO. 1 NAVIGATION WEATHER RADAR IND (D2)

NO. 1 NAVIGATION WEATHER RADAR R T (D3)

NO. 2 NAVIGATION WEATHER RADAR IND (D20)

NO. 2 NAVIGATION WEATHER RADAR R T (D21)

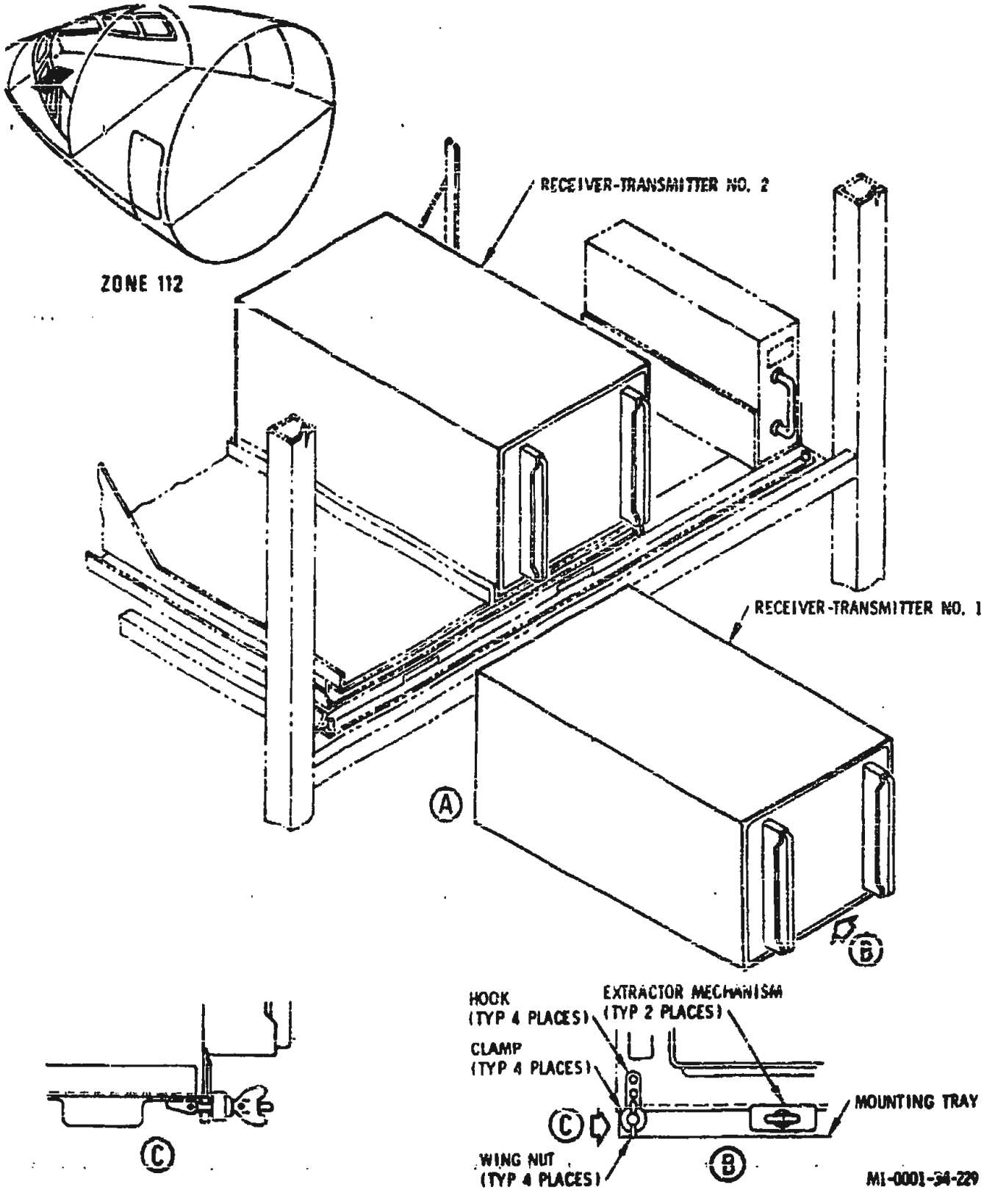
(2) Open access door 112AB and enter forward electronic service center. Locate weather radar receiver-transmitters No. 1 and No. 2 on dual-mounting tray in forward avionics rack (Ref. Fig. 401).

(3) Loosen wing nuts and disengage clamps from hooks on front panel securing receiver-transmitter to be removed.

(4) Rotate extractor thumbscrew counterclockwise until connectors, waveguide flange, and index pins on rear of unit clear mounting tray.

(5) Using handles on front panel, lift receiver-transmitter free of extractor mechanism and remove.

(6) Place protective covers over waveguide flanges and electrical connectors on both mounting tray and receiver-transmitter.



R Weather Radar Receiver-Transmitter - Removal and Installation
R Figure 401

B. Installation

(1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

(2) Remove protective covers from waveguide flanges and electrical connectors on mounting tray and receiver-transmitter.

(3) Place receiver-transmitter on mounting tray with bottom edge of front panel in slot provided on extractor mechanism.

(4) Rotate extractor thumbscrew clockwise to engage rear of unit with mounting tray.

CAUTION: ENSURE CONNECTORS, WAVEGUIDE FLANGES, AND INDEX PINS ARE PROPERLY ENGAGED.

(5) Rotate extractor thumbscrew until receiver-transmitter is firmly seated.

(6) Position clamps on receiver-transmitter hooks and tighten.

(7) Close and secure access door.

(8) Remove tags and close circuit breakers opened in Step 3A(1).

R (9) Perform weather radar system Operational Test, Step 3B
R (Ref. 34-44-00, 501 Adjustment and Test).

WEATHER RADAR CONTROL PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

   34-44-00 Weather Radar System - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

      NO. 1 NAVIGATION WEATHER RADAR IND (D2)

      NO. 1 NAVIGATION WEATHER RADAR R T (D3)

      NO. 2 NAVIGATION WEATHER RADAR IND (D20)

      NO. 2 NAVIGATION WEATHER RADAR R T (D21)

      (2) Locate weather radar control panel mounted in pilots center console, zone 210, (Ref. Fig. 401).

      (3) Release Dzus fasteners.

      (4) Pull panel out far enough to gain access to connectors on control panel rear.

      (5) Disengage aircraft cable connectors from receptacles.

      (6) Remove control panel.

   B. Installation

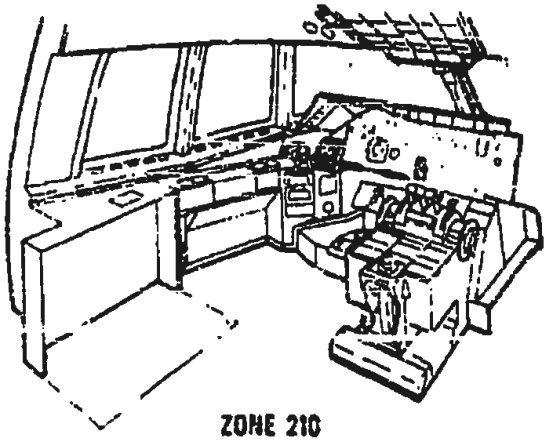
R   (1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Position weather radar control panel on pilots center console.

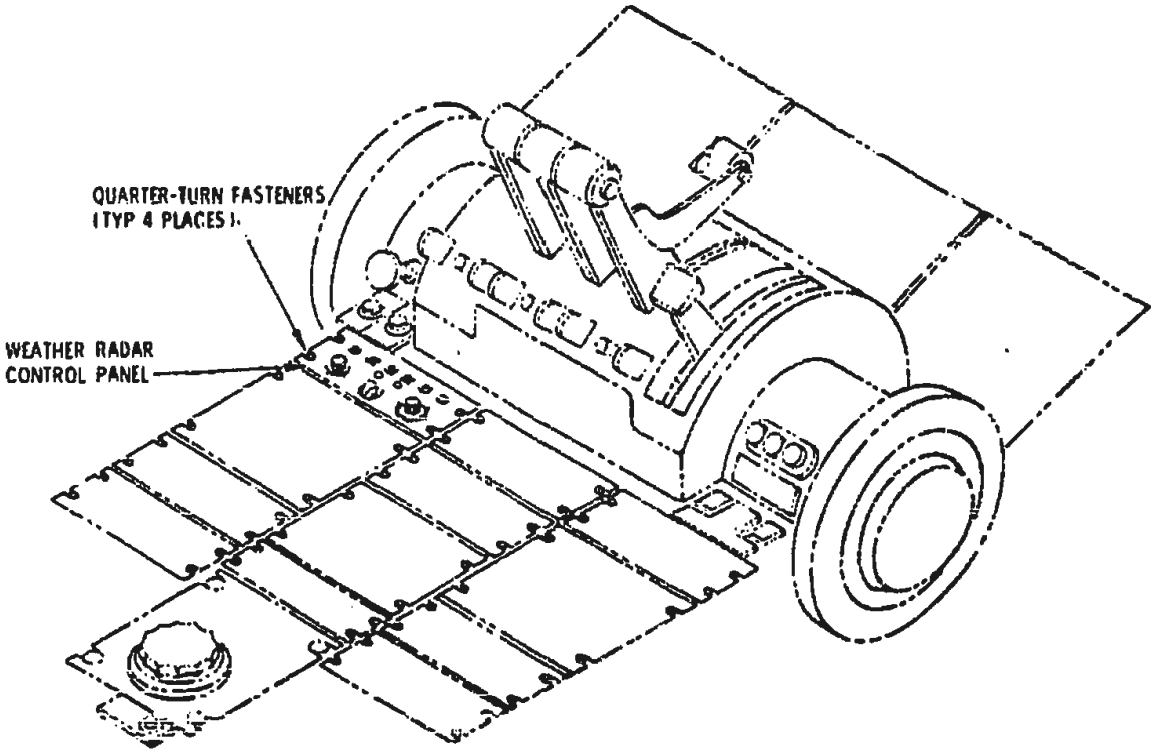
      (3) Engage aircraft cable connectors with receptacles on control panel.

      (4) Install control panel in pilots center console.

      (5) Secure Dzus fasteners.



ZONE 210



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Weather Radar Control Panel - Removal and Installation
Figure 401

(6) Remove tags and close circuit breakers opened in Step 2A(1).

R (7) Perform weather radar Self-Test procedure (Ref.
R 34-44-00, Page 501).

WEATHER RADAR ANTENNA - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-44-00 Weather Radar System - Adjustment and Test

2. Equipment and Materials

Protective Cover, Technical Plastic Corp., Part No. 020-108, or equivalent

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers.

NO. 1 NAVIGATION WEATHER RADAR IND (D2)

NO. 1 NAVIGATION WEATHER RADAR R T (D3)

NO. 2 NAVIGATION WEATHER RADAR IND (D20)

NO. 2 NAVIGATION WEATHER RADAR R T (D21)

(2) Open nose radome, zone 111, by releasing latches and raising self-supporting hinged radome (Ref. Fig. 401 and 402).

NOTE: The reflector and antenna feed must be removed prior to antenna removal.

CAUTION: HANDLE REFLECTOR WITH CARE.

(3) Insert locking pin with flag attached into locking position hole.

(4) Remove screws and lock washers securing actuator dust cover to antenna feed.

(5) Remove screw and washers securing connector P1002 to connector J1002 and disengage connectors.

CR CR CAUTION: DO NOT ALLOW ALLEN WRENCH TO CONTACT AND BEND PINS ON FEED ASSEMBLYS CONTROL RELAY.

(6) Remove screws and lock washers securing antenna feed to waveguide flange.

(7) Remove screws and lock washers securing reflector to reflector ring.

(8) Disconnect connectors J1000 and J1100 from receptacles on lower side of antenna pedestal.

(9) Disconnect and cap waveguide on upper side of antenna pedestal by releasing quick-disconnect.

WARNING: ANTENNA PEDESTAL REMOVAL REQUIRES TWO MEN.

(10) Loosen, but do not remove, upper bolts.

(11) Remove lower mounting bolts securing antenna pedestal to bulkhead.

(12) Carefully lift antenna pedestal off upper bolts and remove.

B. Installation

(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) If not installed, insert locking pin with flag attached into locking position hole.

WARNING: ANTENNA PEDESTAL INSTALLATION REQUIRES TWO MEN.

(3) Lift antenna pedestal over upper mounting bolts, lower into position.

(4) Place lower bolts through antenna pedestal into bulkhead.

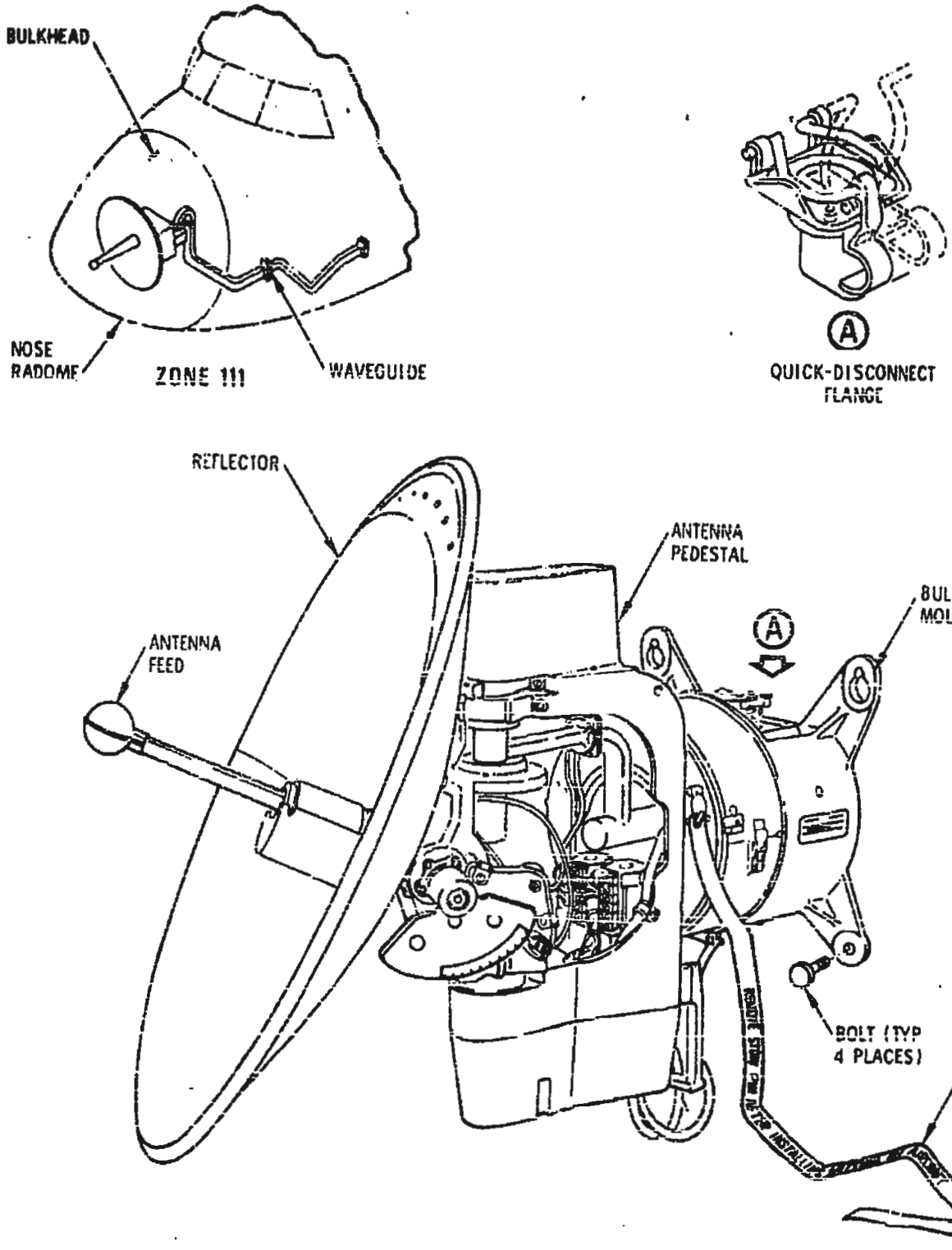
(5) Torque upper and lower mounting bolts to within 185 to 205 inch-pounds.

(6) Remove protective cover from antenna waveguide flange and connect to waveguide. Secure connection with quick-disconnect.

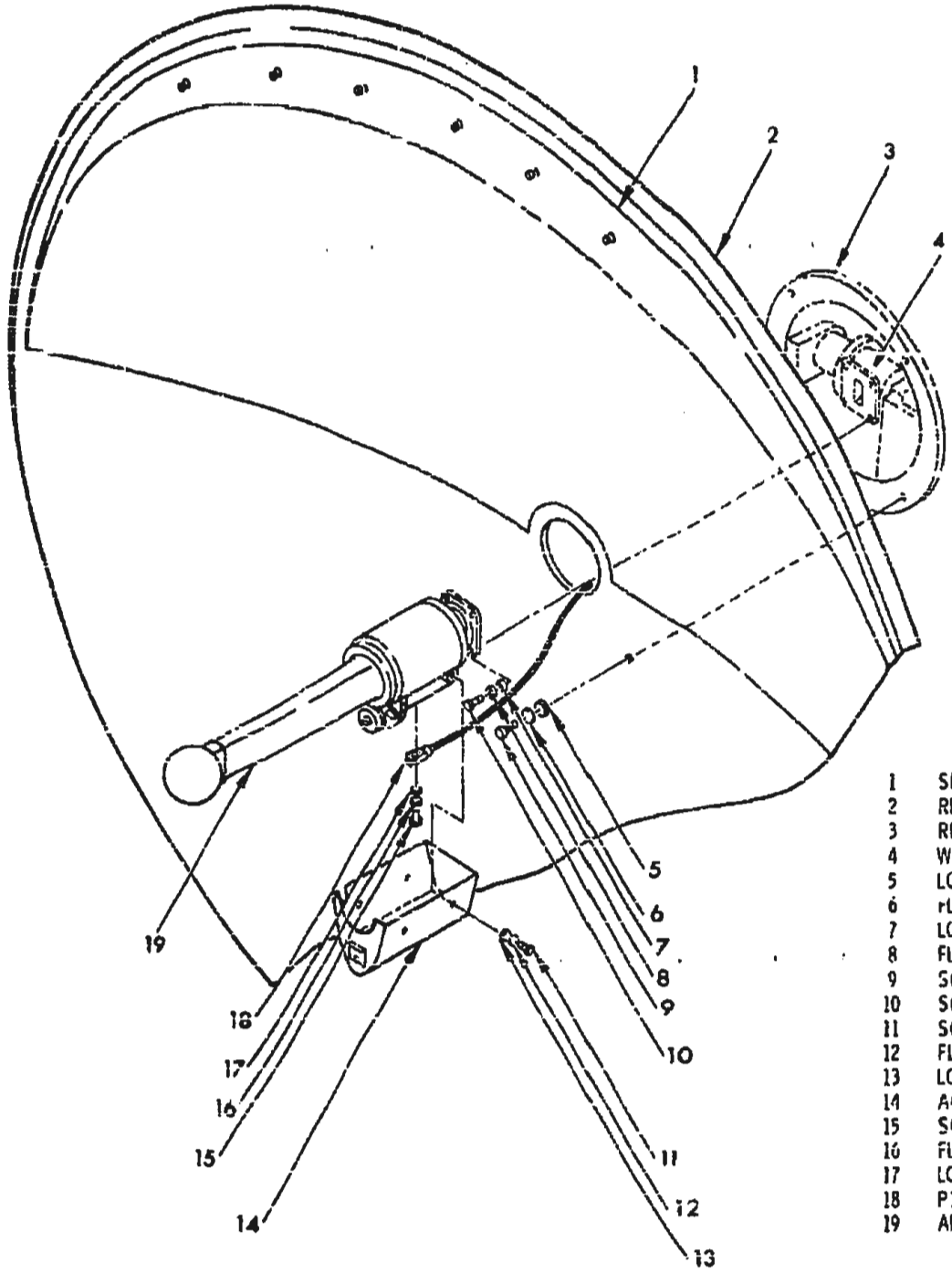
(7) Connect connectors J1000 and J1100 to receptacles on lower side of antenna pedestal.

CAUTION: PROTECT REFLECTOR AND FEED FROM DAMAGE.

(8) Position reflector so spoiler is horizontal and above feed axis.



Weather Radar Antenna - Removal and Installation
Figure 401



1	SPOILER
2	REFLECTOR
3	REFLECTOR RING
4	WAVEGUIDE FLANGE
5	LOCK WASHERS (4)
6	FLAT WASHERS (4)
7	LOCK WASHERS (4)
8	FLAT WASHERS (4)
9	SCREWS (4)
10	SCREWS (4)
11	SCREWS (4)
12	FLAT WASHERS (4)
13	LOCK WASHERS (4)
14	ACTUATOR DUST COVER
15	SCREW
16	FLAT WASHER
17	LOCK WASHER
18	P1002 CONNECTOR
19	ANTENNA FEED

HH 5970
M1-7200-34-233

Reflector and Antenna Feed - Removal and Installation
Figure 402

(9) Secure reflector to reflector ring with screws and lock washers.

CR CR CAUTION: DO NOT ALLOW ALLEN WRENCH TO CONTACT AND BEND PINS ON FEED ASSEMBLYS CONTROL RELAY.

(10) C C Secure antenna feed to waveguide flange with screws and lock washers. Install a new "O" ring Mfg P/N MS90064-13 between antenna feed and waveguide.

NOTE: Install antenna feed so waveguides match and are properly orientated.

(11) C C Install new "O" ring Mfg. P/N MS90064-13 at antenna probe.

(12) If secured, remove screw and washers securing connector P1002 to connector J1002.

(13) Locate connector P1002 on end of cable leading from antenna frame and pass through reflector mounting hole at base of antenna feed.

(14) Engage connector P1002 to connector J1002 and secure with screw and washers.

(15) Replace actuator dust cover and secure with screws and washer.

(16) Remove locking pin with flag.

(16) Close and latch radome.

(17) Remove tags and close circuit breakers opened in Step 2A(1).

(18) Perform weather radar Self-Test procedure, verify targets are being received by operating system in NORM position with aircraft in suitable location (Ref. 34-44-00, Page 501).

CAUTION: WHEN OPERATING RADAR, OBSERVE CAUTIONS AND WARNINGS IN 34-44-00, ADJUSTMENT AND TEST PROCEDURE.

WEATHER RADAR INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

34-44-00 Weather Radar System - Adjustment and Test

2. Removal/Installation

A. Removal

CAUTION: NEVER PLACE INDICATOR FACE DOWN. ALWAYS HANDLE INDICATOR FACE UP OR IN HORIZONTAL POSITION.

NEVER PLACE INDICATOR WITHIN 4 FEET OF RECEIVER-TRANSMITTER.

R (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

NO. 1 NAVIGATION WEATHER RADAR IND (D2)

NO. 1 NAVIGATION WEATHER RADAR RT (D3)

NO. 2 NAVIGATION WEATHER RADAR IND (D20)

NO. 2 NAVIGATION WEATHER RADAR RT (D21)

(2) Locate indicator on Captains or First Officers instrument panel, zone 211 or 212, (Ref. Fig. 401).

(3) Before removing Captains weather radar indicator, remove nose gear steering wheel as follows:

(a) Pry off plug button on hub of nose gear steering wheel.

(b) Remove nut and washer securing nose gear steering wheel to shaft.

(c) Lift nose gear steering wheel off shaft.

(d) Mark with a pencil the position of turn indicator plate in relation to nose gear steering shaft.

(e) Loosen clamp holding indicator plate.

(f) Remove plate.

R R (4) Pull handle on bottom of indicator front panel far enough out so extractor-type locking lever is accessible.

(5) Grasp locking lever by hole and rotate to right to release and extract indicator.

(6) When indicator has moved forward, indicator locking pin is disengaged from locking lever, and holddown pins located on each side of mounting tray, are disengaged. Pull indicator forward and lift out.

B. Installation

R (1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Rotate locking lever on mounting tray counterclockwise (open) position.

(3) Place indicator on mounting tray and slide back until connector on rear of unit is aligned with mating connector on mounting tray.

(4) Using hole in lever, rotate locking lever slowly clockwise. Rotate locking lever 90 degrees to R counterclockwise (locked) position and ensure holddown pins in mounting tray are engaged with holes in lower front panel.

(5) Remove tags and close circuit breakers opened in Step 2A(1).

(6) If Captains weather radar indicator was installed, install nose gear steering wheel as follows:

(a) Install nose gear steering indicator plate on shaft. Pencil marks scribed in Step 2. (3)(d) must be lined up properly.

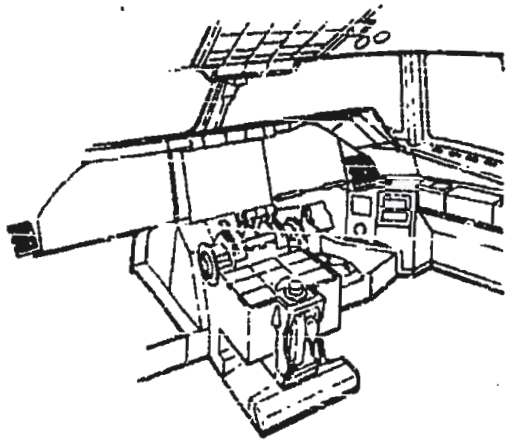
(b) Tighten indicator plate clamp.

(c) Install nose gear steering wheel on shaft.

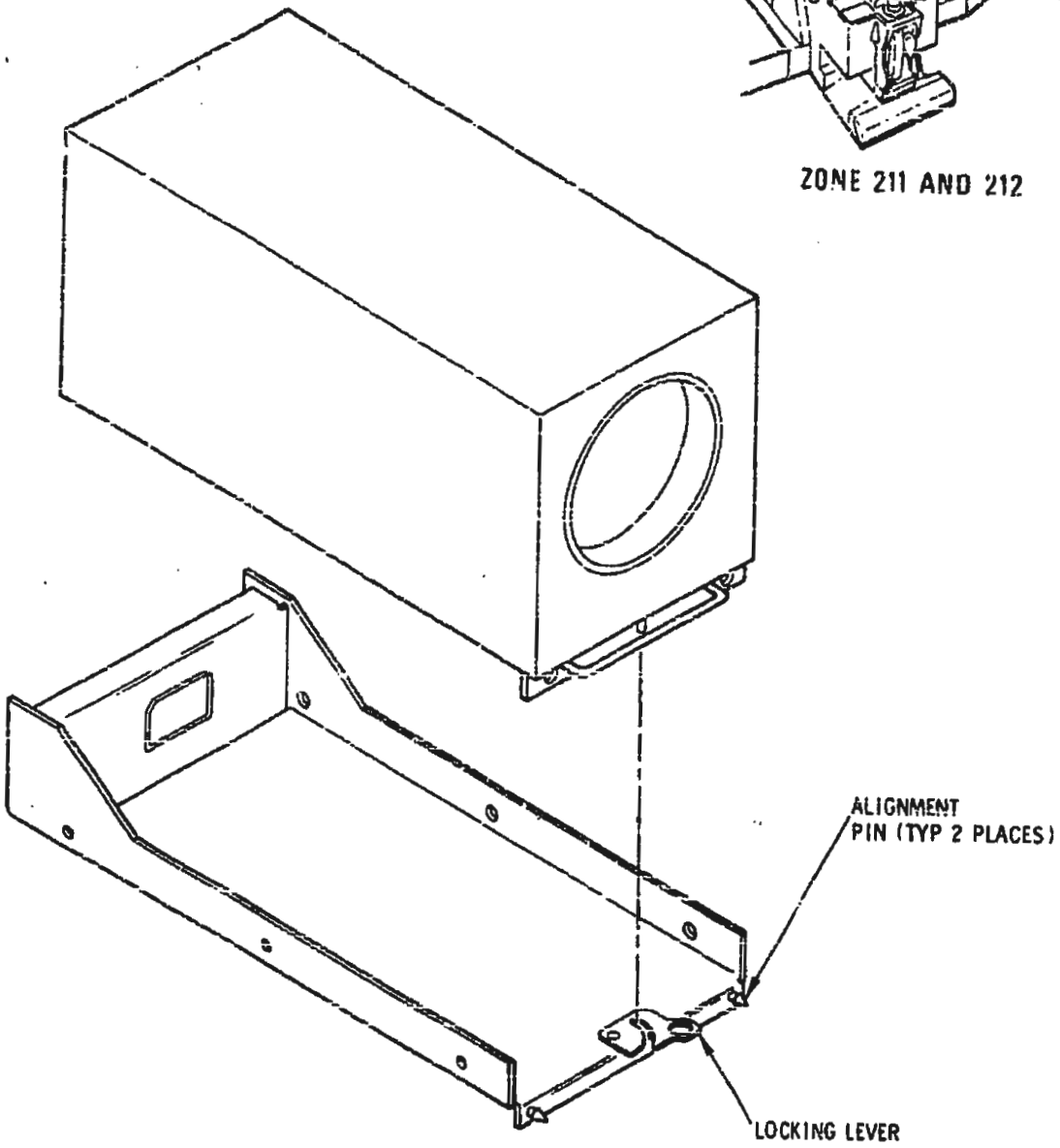
(d) Secure nose gear steering wheel to shaft with washer and nut.

(e) Install plug button on nose gear steering wheel.

R R (7) Perform weather radar system self-test procedure (Ref. 34-44-00, page 501).



ZONE 211 AND 212



HH 5958
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Weather Radar Indicator - Removal and Installation
Figure 401

WEATHER RADAR WAVEGUIDE SWITCH - REMOVAL AND INSTALLATION

1. Reference Procedure

34-44-00 Weather Radar System - Adjustment and Test

2. Equipment and Materials

Waveguide Protective Cover, Part No. 1591482, or Technical Plastic Corp., Part No. 020-108.

3. Removal/Installation

A. Removal

(1) Perform Weather Radar Receiver - Transmitter removal procedure; 34-44-01, Steps 3A(1) through (6).

NOTE: Accessibility to waveguide switch is somewhat limited and requires a certain amount of sight unseen movements.

(2) Locate Weather Radar Waveguide switch mounted on rear of dual receiver-transmitter mounting tray (Figure 401).

(3) Reach under R-T mounting tray and remove electrical connector from bottom of waveguide switch. Protect R connector by placing in plastic bag or other suitable container.

(4) On forward side of waveguide switch, remove four captive socket head screws and lockwashers to free flexible waveguide section going to radar antenna.

(5) On aft side of waveguide switch, remove four captive socket head screws and lockwashers to free switch from its mounting bracket. Save waveguide switch cover plate from port 4 for reuse, insert into plastic bag or suitable container and attach to switch mounting bracket.

(6) On both sides of waveguide switch, remove eight captive socket head screws and lockwashers to free flexible waveguide sections coming from rear of each rack.

(7) Remove waveguide switch by lifting upward.

(8) Install protective covers on open waveguide flanges.

R (9) To keep foreign material from entering open waveguide switch ports, put switch in plastic bag or other suitable container.

B. Installation

(1) Remove protective covers from waveguide flanges.

R (2) Verify port 2 as identified on waveguide switch is forward. Insert waveguide switch down between flexible R waveguides and mounting bracket, make sure port 4 cover C plate is between switch and bracket. Ref. Fig. 401 C for proper waveguide switch orientation.

(3) On both sides of waveguide switch, install eight captive socket head screws and lockwashers to secure flexible waveguide sections to waveguide switch.

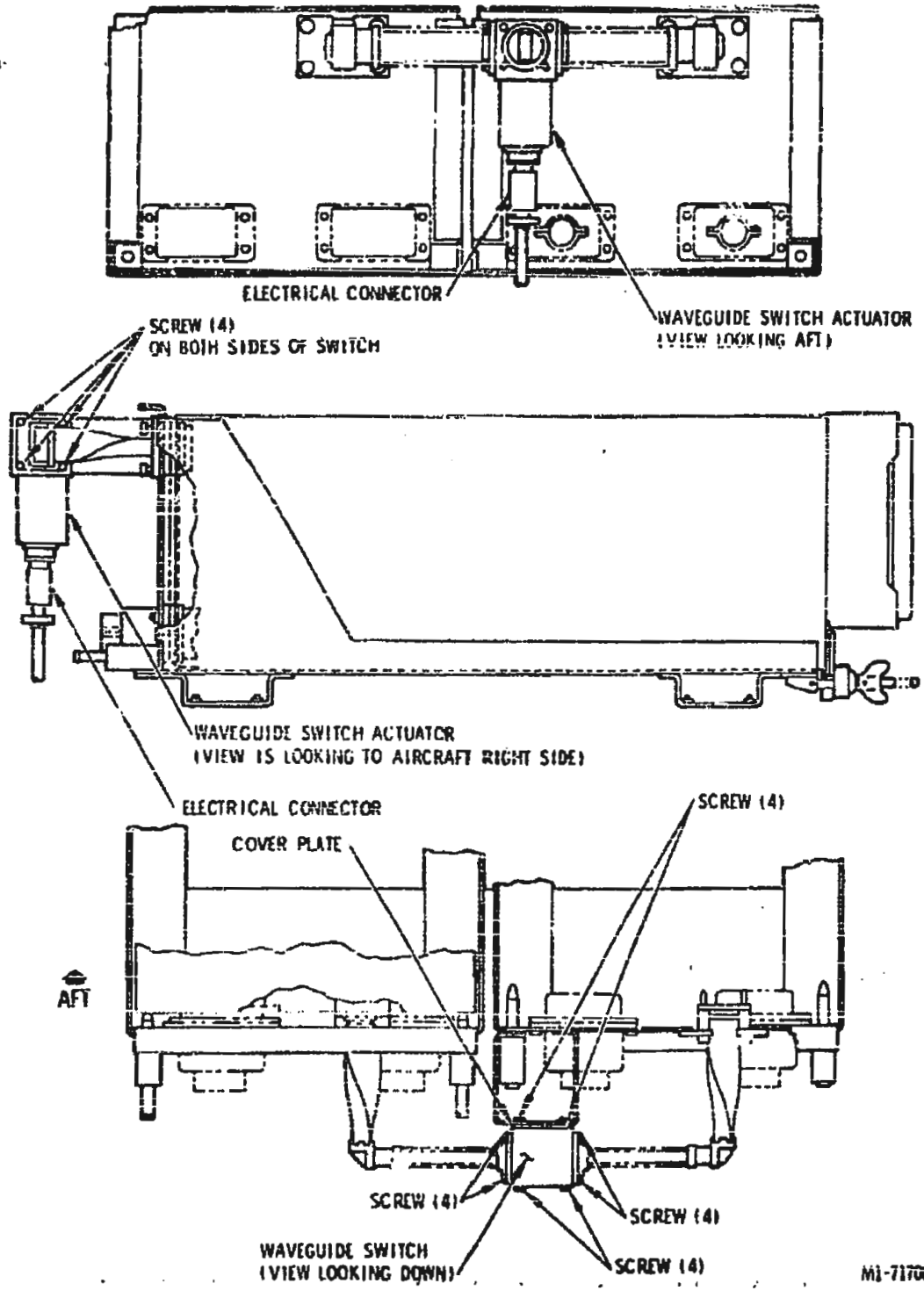
(4) On aft side of waveguide switch, install four captive socket head screws and lockwashers to secure waveguide switch to mounting bracket.

(5) On forward side of waveguide switch, install four captive socket head screws and lockwashers to secure flexible waveguide section to waveguide switch.

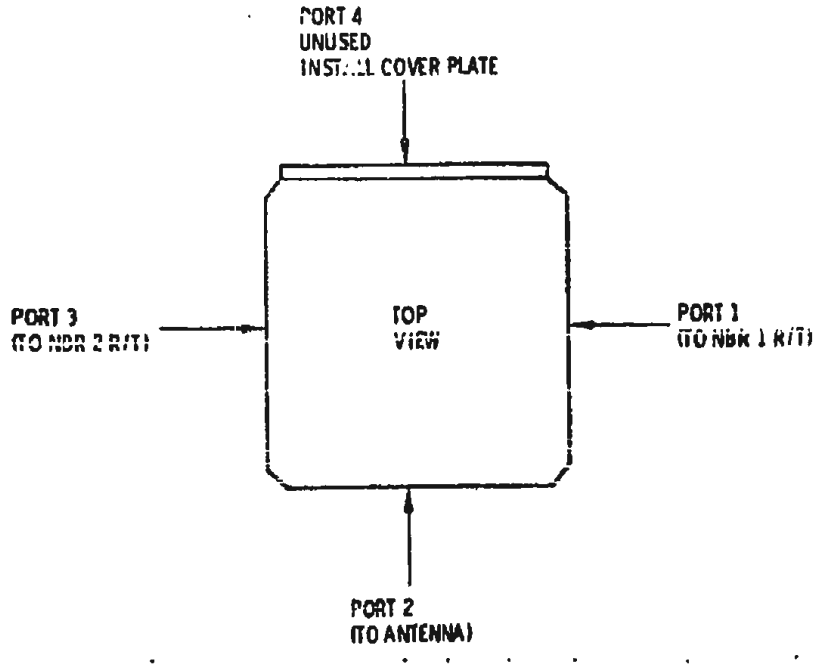
(6) Remove protective container from electrical connector and insert into bottom of waveguide switch.

(7) Perform Weather Radar Receiver - Transmitter installation procedure; 34-44-01, Paragraph 3B(1) through (9).

R (8) Perform weather radar system Self-Test procedure (Ref. R 34-44-00, page 501).



Waveguide Switch, Removal and Installation
Figure 401



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CR
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Waveguide Switch Orientation
Figure 402

R
R
001B

EFFECTIVITY: ALL

GROUND PROXIMITY WARNING SYSTEM - DESCRIPTION AND OPERATION

1. General

A. The Ground Proximity Warning System (GPWS) was designed to provide the flight crew with an unmistakeable advance warning of imminent inadvertent terrain contact. This warning provides the flight crew with sufficient time to take the necessary corrective action. As this system requires no pilot input, and warns only for a potentially dangerous flight condition while remaining silent during normal operations, a GPWS warning should not become routine.

B. System Description

(1) The GPWS consists of a Flight Profile Comparator (FPC), two red warning lights, one on each pilots panel, and an amber monitor light. Signal inputs providing radio altitude, barometric altitude, glideslope, landing gear and flap position are utilized. Both aural and visual warnings are produced for five warning modes.

2. Operation

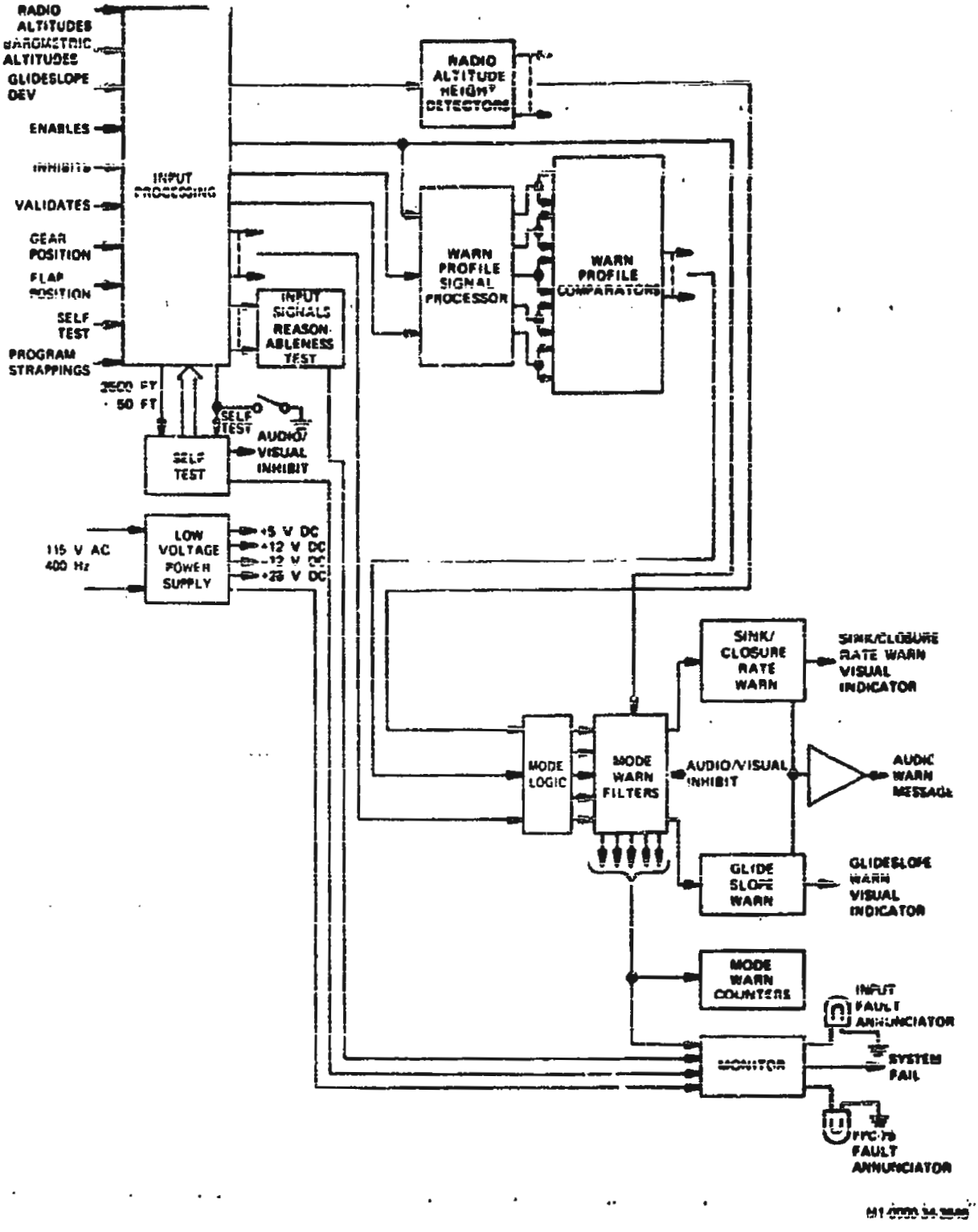
A. The Flight Profile Comparator processes all input parameters, compares these signals to pre-programed rate curves, and through decision logic enables any required warning outputs. (See Figure 1 block diagram of FPC.) The following sections describe each function in greater detail.

(1) Input Signal Processing

(a) Radio altitude processing (See Figure 2)

1) The nonlinear altitude signal from the radio altimeter is first buffered and then linearized via an analog function generator. The linearized signal is then passed through a variable time constant filter whose time constant is programmed as a function of the radio altitude. This provides maximum filtering at low altitudes, where the radio altitude data can be masked by terrain noise, and minimum filtering at high altitudes.

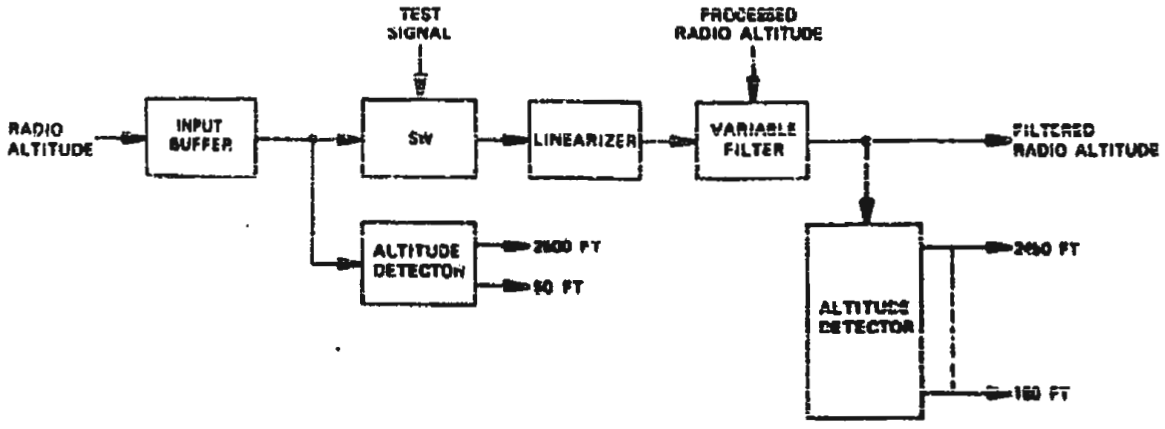
2) Logic signals that define the maximum and minimum warning profile trip panels are derived from this filtered output. The systems operational range trip points (50, and 2500 feet) are generated from the buffered radio altitude



Flight Profile Comparator
Figure 1

EFFECTIVITY: ALL

C signal prior to the insertion of the self-test
CR signal. This allows the self-test system to
CR monitor the radio altitude limits of the warning
C profiles and yet terminate the self-test mode when
C in the systems operational range.



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CR Radio Altitude Processing
CR Figure 2

C (2) Barometric Altitude Processing (See Figure 4).

C (a) The 400 Hz synchro input signal is converted into
C sin θ and cos θ signals via a Scott Tee
C transformer equivalent. The Scott Tee function
C will be implemented with two amplifiers with
C switchable gains to allow scale changing between
C baro fine and KIFIS. The sin θ and cos θ signals
C are then converted into dc sin θ and cos θ signals
C with a synchronous demodulator of the sample and
C hold type. The input reference voltage is
C employed to convert ac phase into dc polarity.
C The dc sin θ and cos θ signals are then passed
C through high-pass filters with very high cutoff
C frequencies to provide the equivalent of
C differentiation. (Go to Figure 3 for paragraph
C conclusion and mathematical formulas).

CR (b) This derived baro rate signal is fed into a
CR variable time constant filter programmed as a
CR function of processed radio altitude. Logical
CR output for use in the digital decision logic is
CR generated from this filtered output.

THE HIGH-PASS OUTPUTS ARE $\cos\theta\left[\frac{d\theta}{dt}\right]$ AND $-\sin\theta\left[\frac{d\theta}{dt}\right]$.

A PAIR OF 4-QUADRANT MULTIPLIERS ARE THEN USED TO PERFORM THE MULTIPLICATIONS INDICATED ON THE BLOCK DIAGRAM. THE OUTPUT AFTER SUMMING IN AN OPERATIONAL AMPLIFIER IS THEN

$$E_{OUT} = (\cos\theta \frac{d\theta}{dt})(\cos\theta) - (-\sin\theta \frac{d\theta}{dt})\sin\theta$$

$$= (\cos^2\theta + \sin^2\theta)\frac{d\theta}{dt} = \frac{d\theta}{dt} = \text{ALTITUDE RATE}$$

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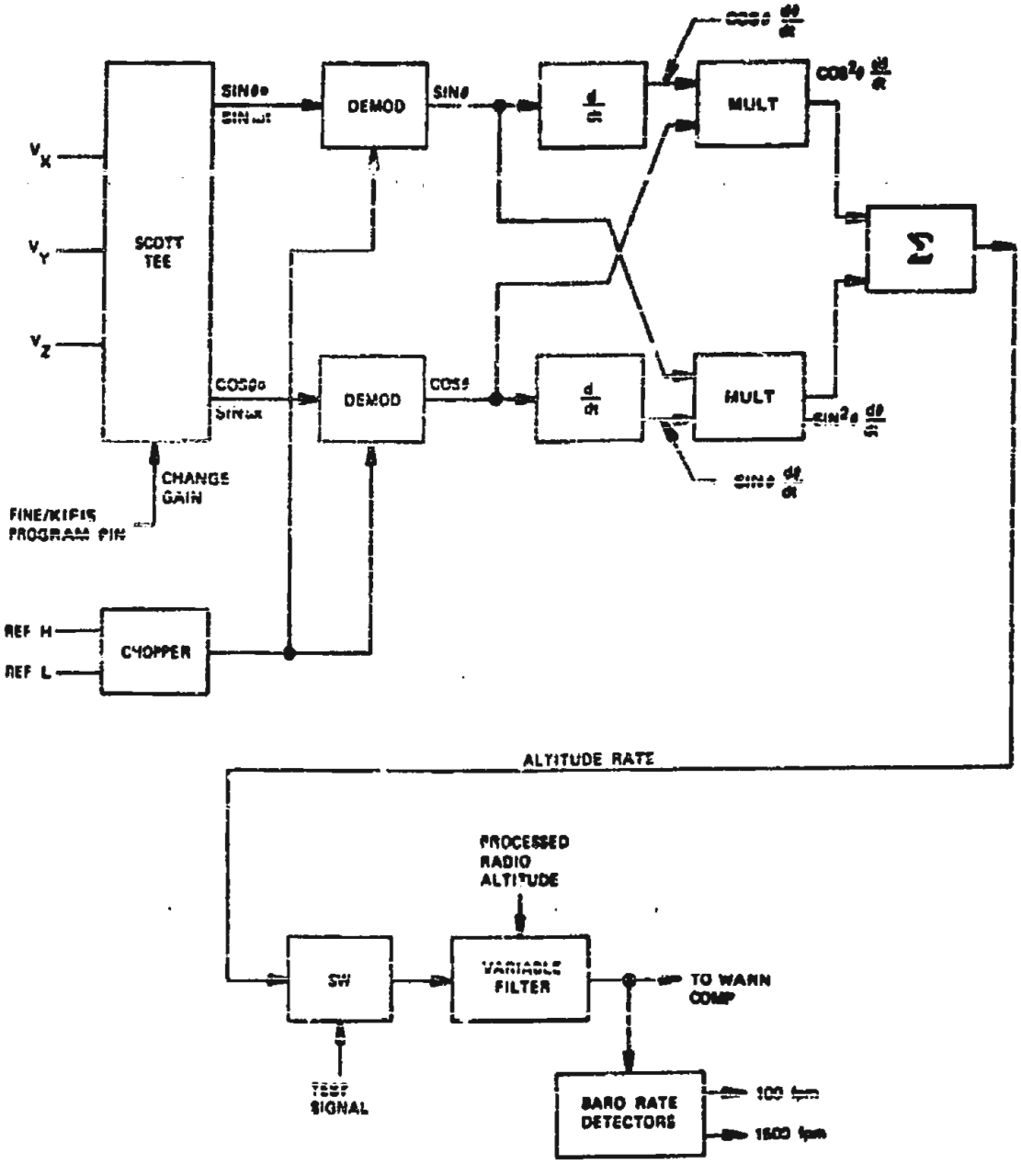
C Mathematical Formula
C Figure 3



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CR
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Barometric Rate Processing
Figure 4

EFFECTIVITY: ALL

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C (3) Warning Computation

CR (a) The warning computation circuitry (Figure 5) CR processes the input signals for each mode, (See CR Figure 6) and compares them to the desired profile C for that mode. The result of each comparison is a C logical discrete, which when combined with the C altitude discretes and the other system input C discretes in the decision logic circuit, can C produce a signal to the warning outputs.

C (b) Slopes for the warning profile curves are C generated by multiplying radio altitude by the C appropriate gain constant. Multiple slope curves, C such as those for modes 1 and 2, are generated by C the addition of two slope segments. In addition C to the comparison circuitry, the warn computation C also includes the circuitry necessary to combine C radio altitude and baro rate to produce the C closure rate data used in mode 2.

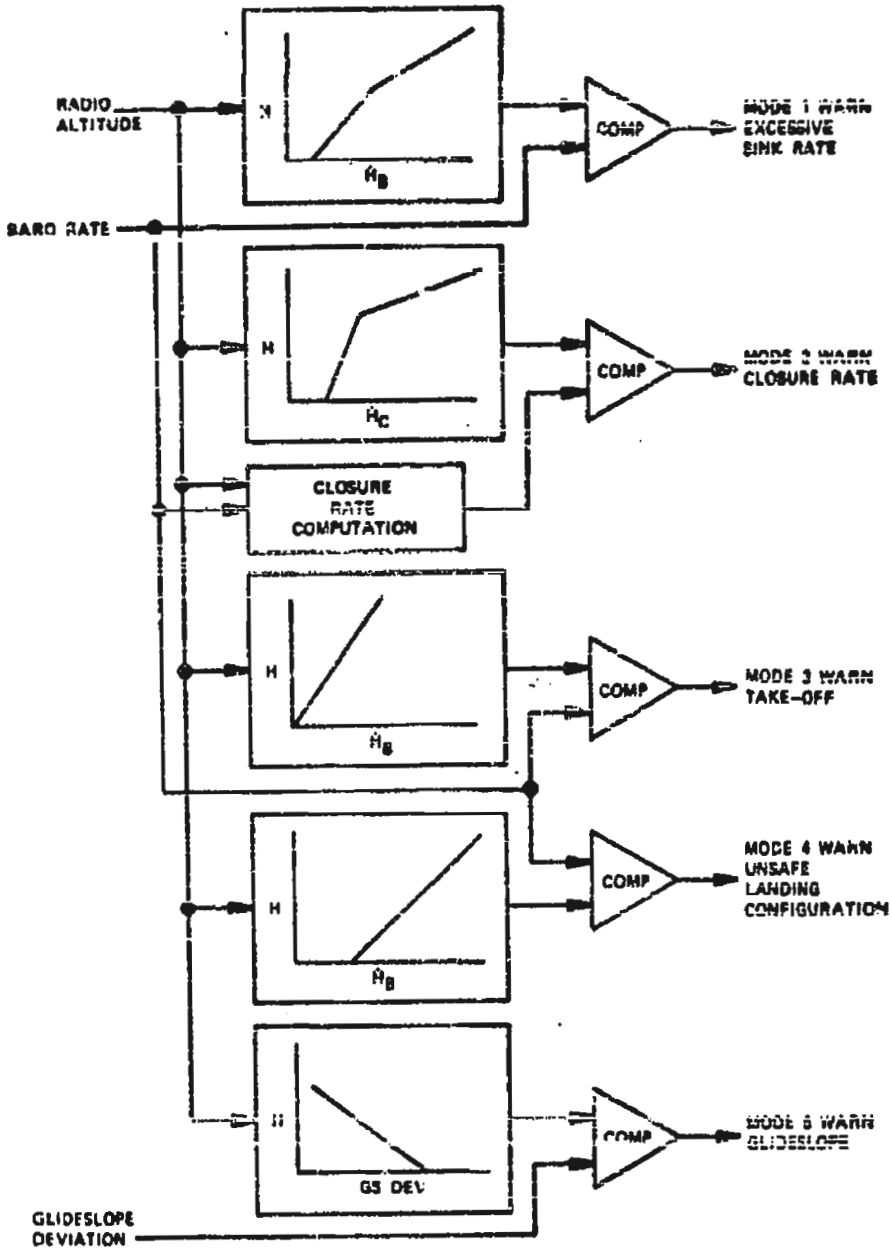
C (c) Both barometric altitude and radio altitude rate C inputs are separately filtered to remove the C principal source of error of each system, then are C combined to obtain true ground closure rate.

CR (4) Decision Logic (See Figure 7).

C (a) The primary function of the decision logic is to C combine the various binary signals generated C elsewhere in the unit and provide WARN commands to C the warn output circuitry. Because the decision C logic is almost entirely combinational logic, it C consists of digital integrated circuits and a few C discrete components that are used for timing C purposes.

C (b) The master inhibit logic enables the WARN outputs C only if the inhibit all modes, radio altitude C valid and internal fault signals are in the proper C states and the primary altitude discretes, 50 and C 2500 ft, indicate that the aircraft is in the C ground proximity altitude range. Self-test is C enabled only if the aircraft is outside of this C altitude range.

C (c) The baro rate valid signal is provided to the C individual mode logic blocks rather than to the C master inhibit block. This is done because the C lack of valid baro rate does not affect mode 5, C nor does it render mode 4 totally inoperative. C Rather, the mode 4 warn profile is modified so



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Warning Computations
Figure 5

C
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EFFECTIVITY: ALL

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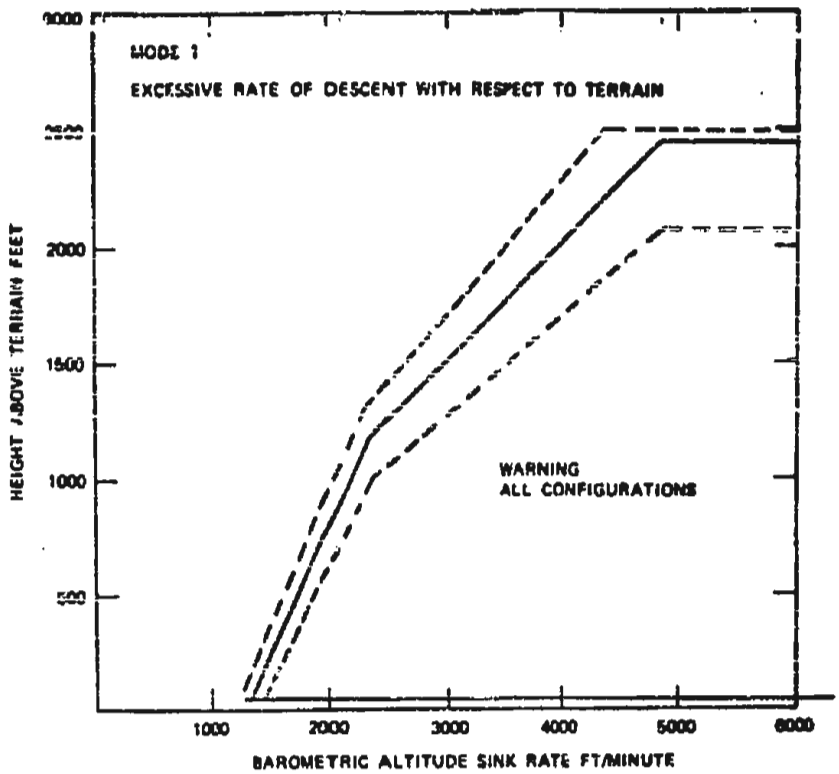

1. SOLID LINES ARE NOMINAL VALUES.
2. DASHED LINES INDICATE TOLERANCE LIMITS.
3. POSITIVE CUT-OFF NECESSARY AT 2500 FEET.
4. NORMAL ARMING HEIGHT ASCENDING IS 50 FEET; MAXIMUM IS 100 FEET.
5. MODE 1 IS FUNCTIONAL AT ALL TIMES BETWEEN 2000 AND 50 FEET.

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C
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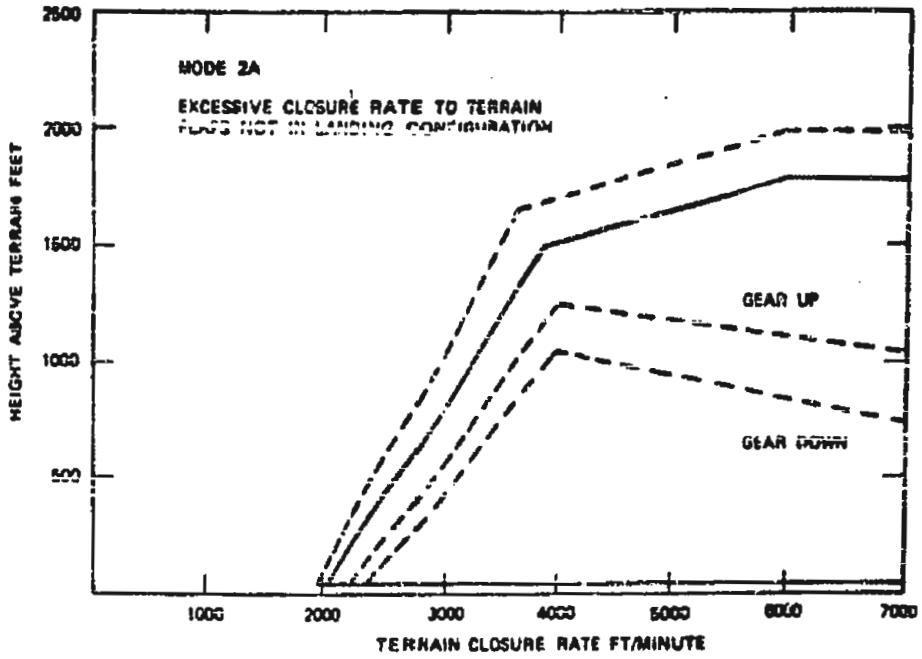
Warning Modes
Figure 6 (Sheet 1)

EFFECTIVITY: ALL

006B



1. SOLID LINES ARE NOMINAL VALUES.
2. DASHED LINES INDICATE TOLERANCE LIMITS, NOTE DIFFERENT TOLERANCE BETWEEN GEAR-UP AND GEAR-DOWN.
3. MODE 2A IS FUNCTIONAL AT ALL TIMES FLAPS ARE NOT IN LANDING CONFIGURATION.

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C
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Warning Modes
Figure 6 (Sheet 2)

EFFECTIVITY: ALL

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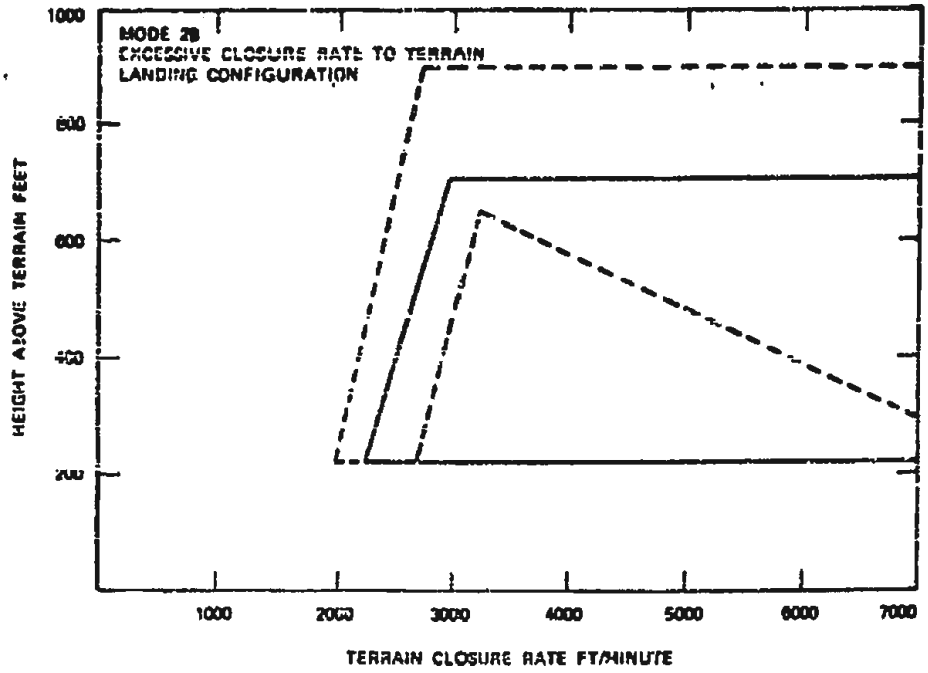

1. SOLID LINES ARE NOMINAL VALUES.
2. DASHED LINES INDICATE TOLERANCE LIMITS.
3. MODE 2B IS FUNCTIONAL AT ALL TIMES FLAPS ARE IN LANDING CONFIGURATION AND IRRESPECTIVE OF GEAR POSITION.

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C
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Warning Modes
Figure 6 (Sheet 3)

EFFECTIVITY: ALL

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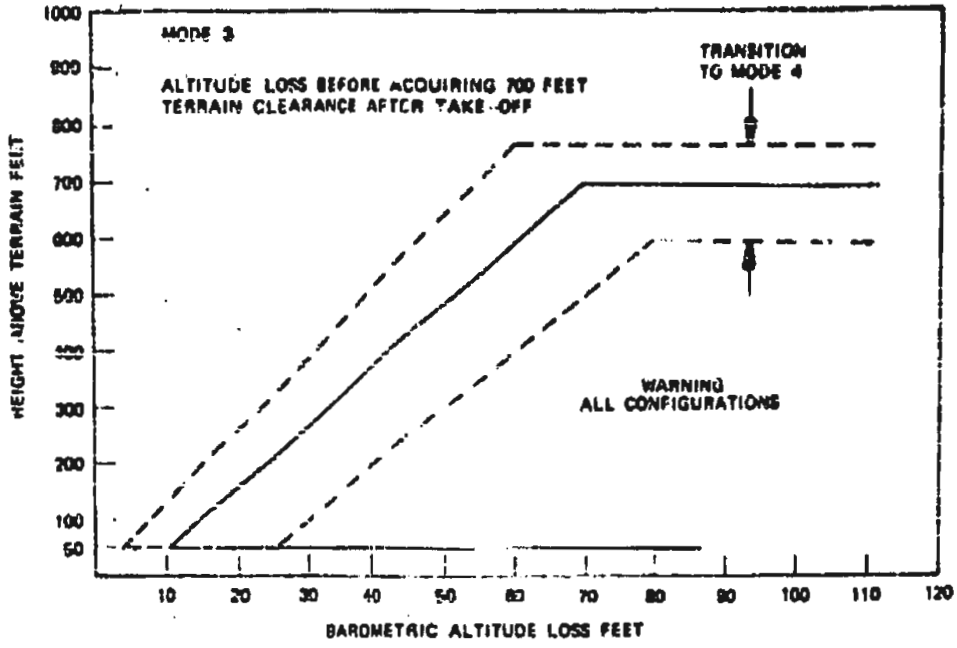

1. SOLID LINES ARE NOMINAL VALUES.
2. DASHED LINES INDICATE TOLERANCE LIMITS.
3. TRANSITION FROM MODE 3 TO MODE 4 MUST OCCUR BETWEEN 600 AND 770 FT.
4. MODE 3 IS FUNCTIONAL DURING TAKE-OFF OR MISSED APPROACH WHEN MODE 4 IS DISABLED.

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C
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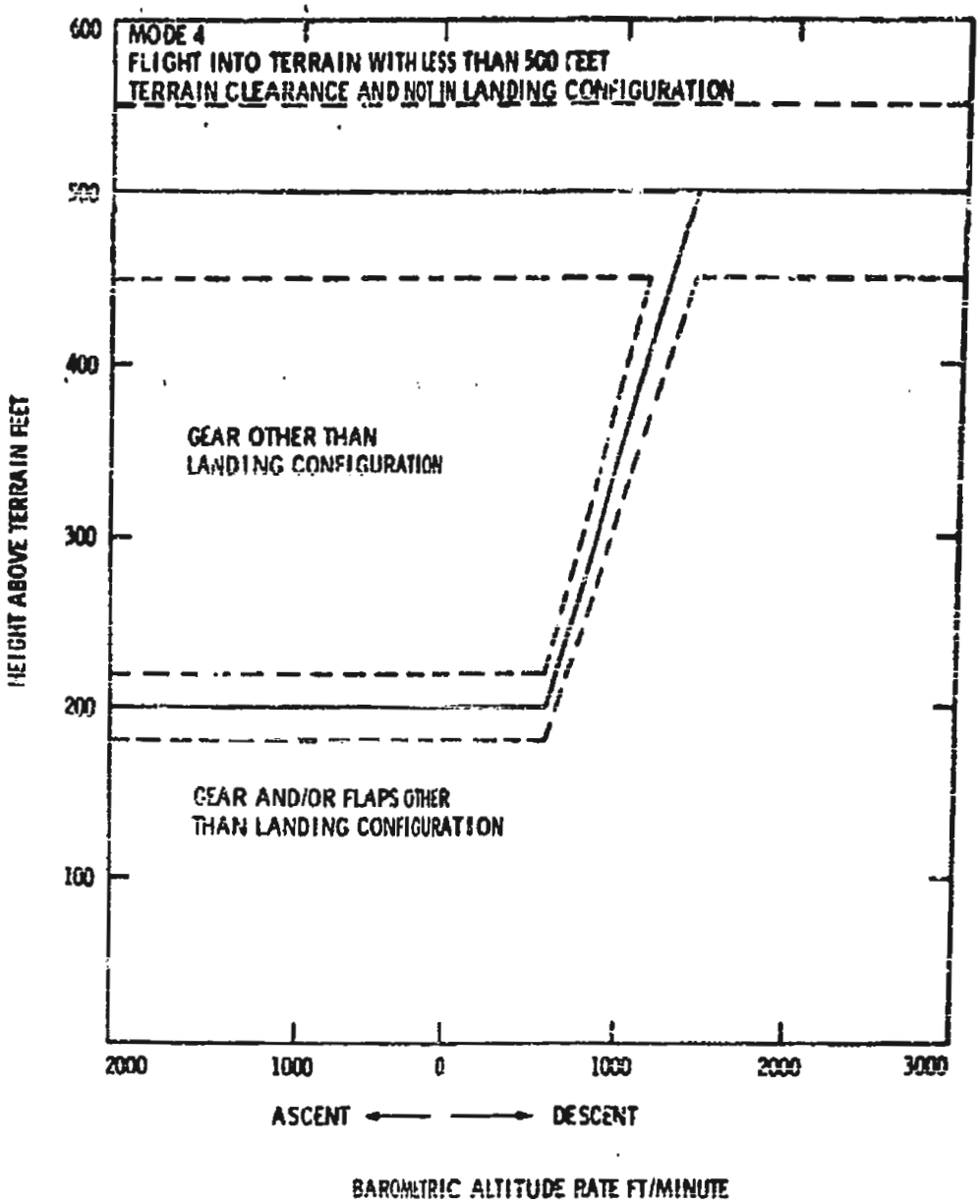
Warning Modes
Figure 6 (Sheet 4)

EFFECTIVITY: ALL

006B



1. SOLID LINES ARE NOMINAL.
2. DASHED LINES INDICATE TOLERANCE LIMITS.
3. AUTOMATIC TRANSFER FROM MODE 4 TO MODE 3 MUST OCCUR WITHIN 2 TO 3 SECONDS UPON CHANGING AIRCRAFT CONFIGURATION (FLAPS OR GEAR POSITION) WITHIN AREA BOUNDED BY GEAR AND/OR FLAPS OTHER THAN LANDING CONFIGURATION ENVELOP WHEN EXECUTING MISSED APPROACH. ABOVE THIS BOUNDARY, AIRCRAFT CONFIGURATION CHANGES SHALL NOT CAUSE TRANSFER OUT OF MODE 4.

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C
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Warning Modes
Figure 6 (Sheet 5)

EFFECTIVITY: ALL

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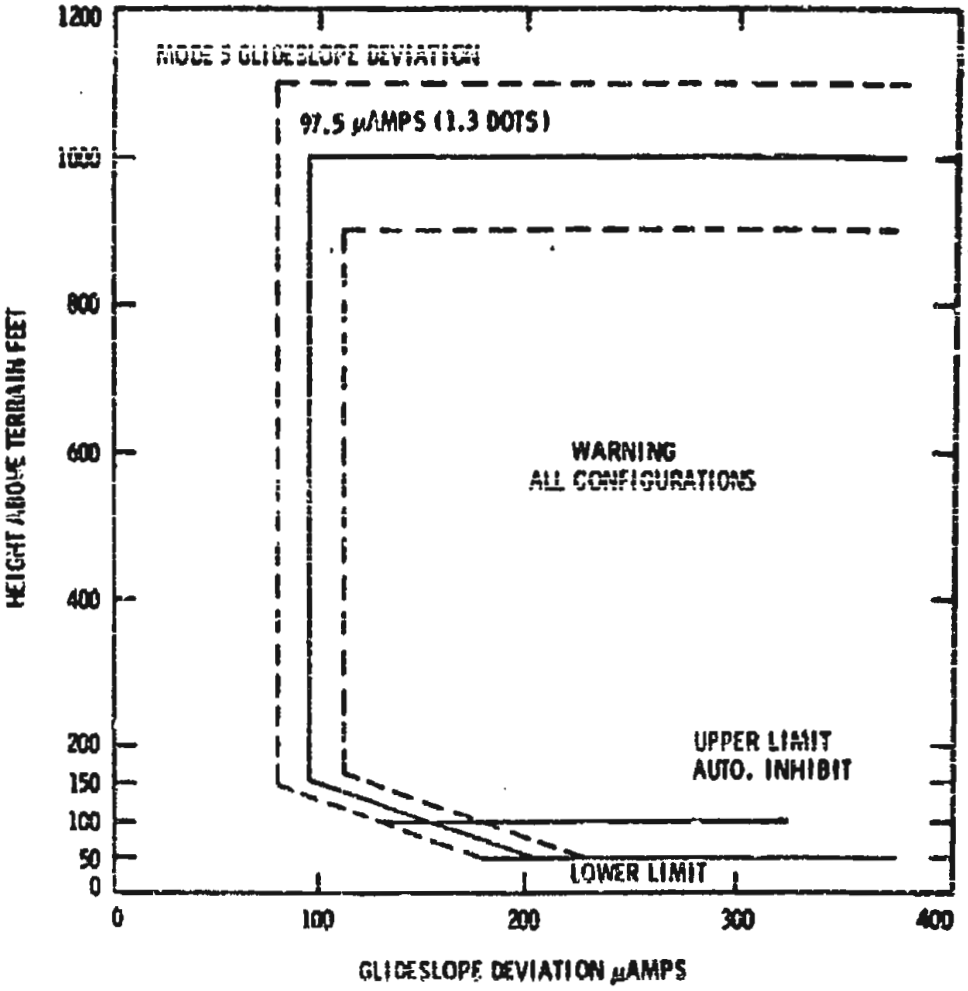

1. SOLID LINES ARE NOMINAL VALUES.
2. DASHED LINES INDICATE TOLERANCE LIMITS.
3. AUTOMATIC INHIBITED AT 100 FEET ABOVE THE TERRAIN.
4. MODE 5 IS DEACTIVATED IF EITHER FLAPS OR GEAR IS IN OTHER THAN LANDING CONFIGURATION.

M1-0000-34-3655

C
CR

Warning Modes
Figure 6 (Sheet 6)

EFFECTIVITY: ALL

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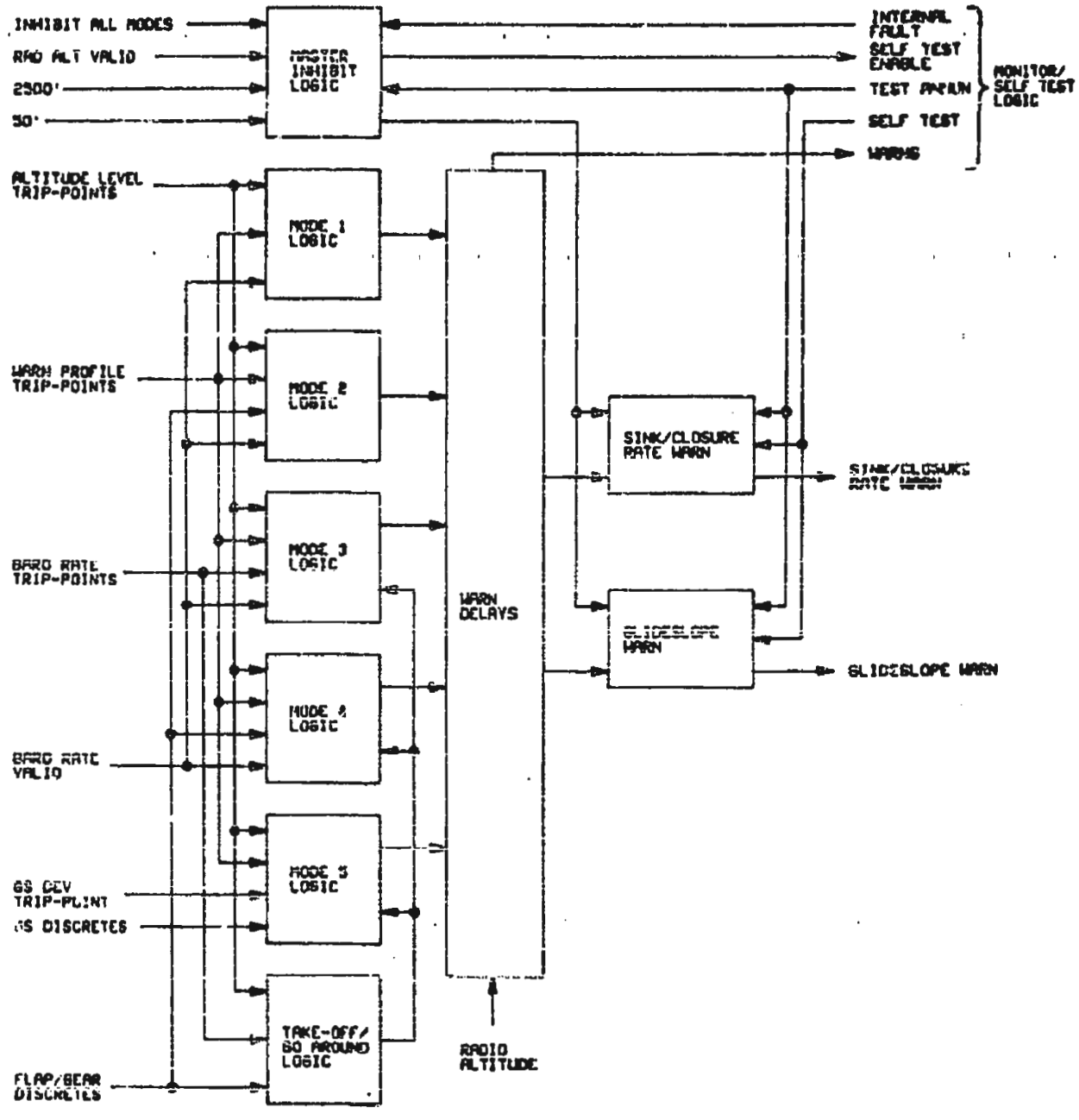
CR that a warn due to incorrect flap position occurs
CR only below a prescribed level of the profile. The
CR glideslope discretes, validity, enable, inhibit
CR and manual inhibit, are provided to the mode 5
CR logic only.

CR (d) Other signals processed by the mode logic
CR circuitry are the various altitude level, baro
CR rate, GS deviation and warn profile trip-points
CR and the flap and gear discretes. The warn profile
CR trip-points indicate whether the aircraft altitude
CR is greater or less than a warn-threshold altitude,
CR which varies as a function of another parameter
CR (altitude rate or glideslope deviation, as
CR appropriate). That is, the warn profile
CR trip-points define the aircraft flight parameters
CR relative to lines of constant altitude, baro rate
CR or glideslope deviation, which appear as
CR horizontal or vertical lines on the warn profile
CR plots.

CR (e) The takeoff/go-around logic inhibits and
CR interlocks warn modes 3, 4, and 5 appropriately so
CR as to minimize nuisance warns. Mode 3 is enabled
CR and modes 4 and 5 disabled if the aircraft remains
CR below 50 feet radio altitude for a time interval
CR and flaps are not in the landing position, or if
CR the gear or flaps are raised during a missed
CR approach. Mode 3 is disabled and modes 4 and 5
CR enabled when the aircraft radio altitude exceeds
CR 700 feet or if either flaps or gear is lowered to
CR its landing position. The enabling of mode 3
CR during a missed approach is delayed to allow time
CR for rotation of the aircraft.

CR (f) No time delays are provided in the individual mode
CR logic blocks except for those appropriate to the
CR enable and inhibit inputs. The master inhibit
CR logic also provides some delay, and this
CR supplements the warn delay so as to minimize the
CR frequency of nuisance warn outputs.

CR (g) The sink/closure rate warn and glideslope warn
CR logic blocks provide for inhibiting the warn
CR outputs in response to the master inhibit logic or
CR during self-test. The test annunciator signal
CR overrides inhibiting action by the primary
CR altitude discretes (50 and 2500 ft) and the
CR self-test discrete, allowing the visual and audio
CR annunciators to be activated. This occurs only
CR when self-test has been manually initiated.



CR
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Decision Logic Block Diagram
Figure 7

EFFECTIVITY: ALL

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CR (5) Warning Logic (See Figures 8 and 9)

C (a) A warn command is received from the computation circuitry and stored in a latch. The output from the warn latch unlocks the WHOOP-WHOOP ramp generator and starts it outputting 0.3 second long, 10-dB amplitude sweep ramps. These ramps control a voltage controlled oscillator and an amplitude modulator to generate a tone with 400- to 800-Hz frequency sweep and a 10-dB amplitude increase. Two ramp cycles are counted, after which the ramp generator is turned off and the clock oscillator gated on. The PROM/ROM address counter output is used to sequentially read out the ROM contents in a 16,384-bit serial stream in 0.7 second. The bit stream is converted into an audio voice signal of PULL-UP, by a demodulator. The voice message is time multiplexed on the audio output immediately after the two oscillator sweeps.

C (b) The warn output circuitry also generates a ground output to activate lamp annunciators. Once initiated, the output warn logic will always cycle through one complete synthesized voice message, even if the warn output command drops during the message.

C (c) In addition to the WHOOP, WHOOP PULL-UP message, ROM's and logic will be included to output the message GLIDESLOPE whenever mode 5 and only mode 5 is entered (Figure 7). Modes 1, 2, 3, and 4, however, will override mode 5 and switch the message generator back to the PULL-UP message.

CR 3. Self-Test and Monitoring

CR A. The self-test and monitoring provisions of the Flight Profile Comparator are intended to verify proper performance to a 90% confidence level.

CR B. These functions can be divided into three types; continuous monitoring, automatic self-test, and manually initiated self-test.

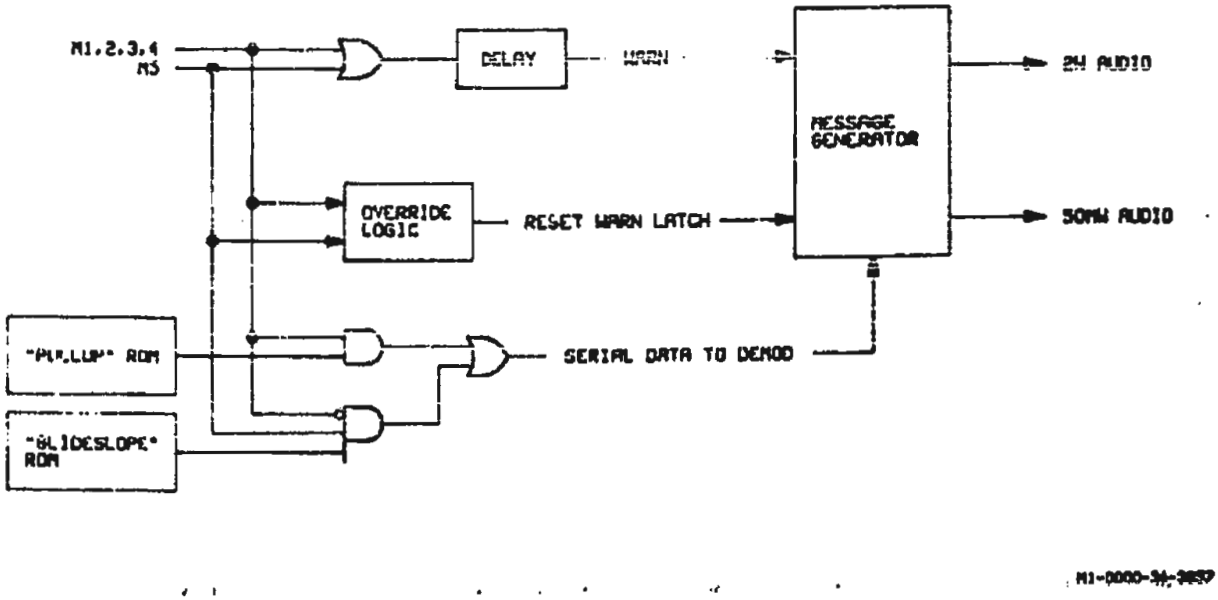
CR (1) Continuous monitoring

CR (a) Sensor validities, enable and inhibit inputs, and under some conditions flap and landing gear inputs, as well as the FPC power supply are continuously monitored. Failure of any of these

CR will illuminate the GPWS MONITOR light and
CR deactivate the system. A fault in an external
CR input will also trip the sensor fault annunciator
CR on the front panel of the FPC. If a power supply
CR malfunction is detected the FPC fault indicator on
CR the front panel of the FPC will be illuminated.

CR (2) Automatic self-test

CR (a) The automatic self-test is enabled only when the
CR radio altitude is less than 50 feet or greater
CR than 2450 feet, and baro altitude descent rate is
CR less than 3000 feet per minute. When enabled a
CR self-test cycle timer repetitively runs through
CR the following self-test conditions; radio altitude
CR from 2000 feet to zero at 6000 feet per minute,
CR baro altitude descent rate of 4000 feet per
CR minute, landing gear not down, and a glideslope
CR deviation of three dots. The self-test logic then
CR examines the results of applying these signals.
CR Each of the five warning decision channels must be
CR indicating a warning situation and the audio
CR monitor must be indicating audio at the power amp
CR output. If one or more of these conditions are
CR absent the GPWS MONITOR light is illuminated and
CR the system is deactivated. A successful



M1-0000-34-2057

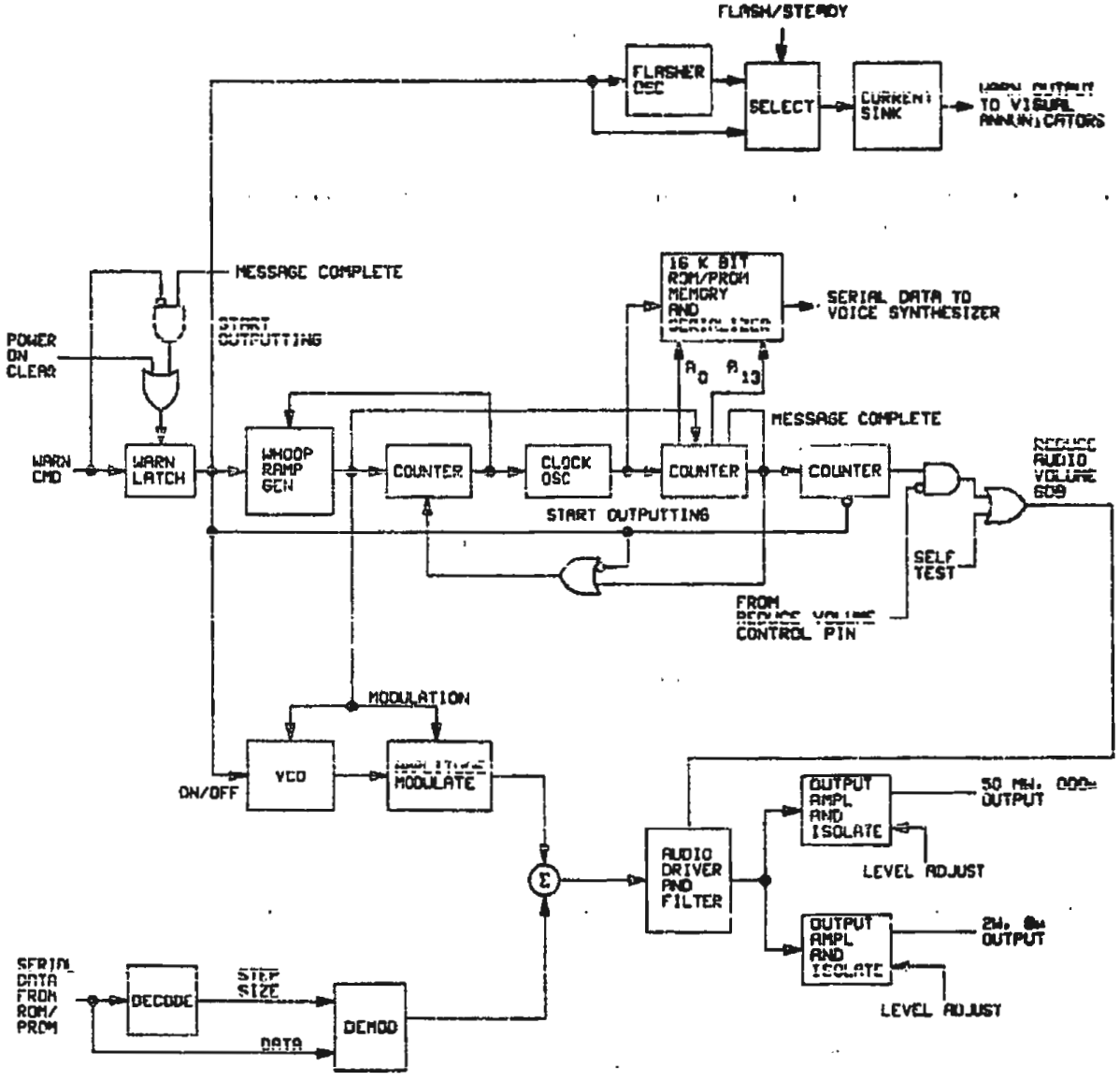
CR Glideslope Output Message Generator
CR Figure 8

CR completion of a subsequent self-test or cycling
CR power off and on will rearm the system.

CR (3) Manual self-test

C (a) Manual self-test is initiated by depressing either
C PULL-UP switch light assembly or the self-test
C pushbutton on the front panel of the FPC. Manual
C self-test is identical to automatic self-test
C except that the audio output drivers and all lamp
C outputs are activated if no fault exist. The
C self-test switch on the front panel of the FPC
C will also reset the sensor fault annunciator if
C tripped.

C (4) Located on the front panel of the FPC are five warning
C occurrence annunciators. Each will trip if a warning
C occurs in the corresponding mode. These annunciators
C will automatically reset when ascending through 100
C feet radio altitude if the aircraft has been at zero
C radio altitude with the flaps not in landing for 12
C seconds.



Warning Output Message Generator
Figure 8

EFFECTIVITY: ALL

C GROUND PROXIMITY WARNING SYSTEM - FAULT ISOLATION

C 1. General

C The diagrams and schematics in this section can be used for
C fault isolation any time a fault is reported or suspected. The
C PREREQUISITES listed at the top of each fault isolation diagram
C must be satisfied prior to starting fault isolation. Uncommon
C abbreviations are defined on the using fault code diagram or
C schematic.

C If the flight crew reports a trouble using a fault code, the
C code number can be found in the 34 Fault Code Index. The index
C specifies the maintenance manual section, fault isolation
C diagram, and block number on the diagram where the fault
C isolation procedure should start. Schematics are included at
C the end of the section to supplement the fault isolation
C diagrams or as an aid in isolating a problem not covered on the
C diagrams.

C Refer to the Maintenance Manual Introduction for a more detailed
C discussion of the Fault Isolation Reporting Method (FIRM) and
C use of fault isolation diagrams/schematics.

C Since no fault isolation reporting system can cover every
C failure symptom, system functional schematics are provided
C giving information for intercomponent signal tracing from source
C to termination.

C To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
C Cross Reference (WM DIA CROSS REF) table on the system
CR functional schematics, which list applicable wiring diagram in
CR L-1011 Wiring Diagram Manual.

C 2. Fault Isolation Identification

C Table 101 lists fault isolation diagrams and schematics in this
C section. Figures 101 and 102 provide component locations for
C the Ground Proximity Warning System.

C Fault Isolation Diagrams and Schematics List
C Table 101

FIGURE NUMBER	TITLE
101	Component Location Index
102	Component Locator Diagram
103	GPWS Monitor Light ON
104	GPWS No Test
105	GPWS Warning during approach
106	GPWS Warning during taxi/takeoff
107	Aural Glideslope warning
108	Aural Warning Inoperative
SCHEM 1	GPWS Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – GROUND PROXIMITY WARNING	1	FESC, REAR RACK/112AB	
LIGHTS – WARNING	2	FLT STA, CAPT AND F/O INSTR PNL	20-33-04
LIGHT – GP MON	1	FLT STA, CTR INSTR PNL	20-33-04
SPEAKER – GPWS	1	FLT STA, PILOTS OVHD PNL	

M1-5000-34-3383

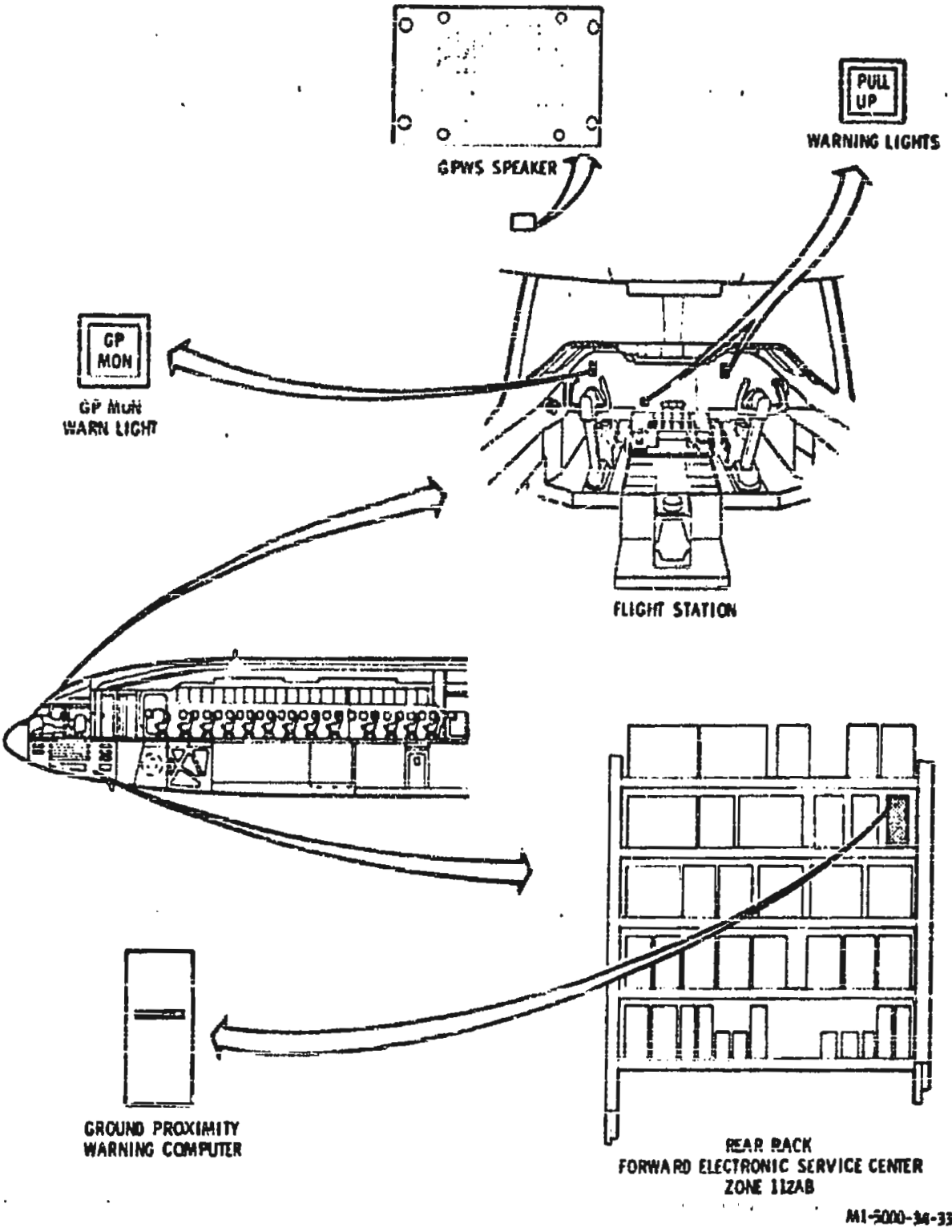
C C

Component Location Index
Figure 101

R R

EFFECTIVITY: ALL

001B



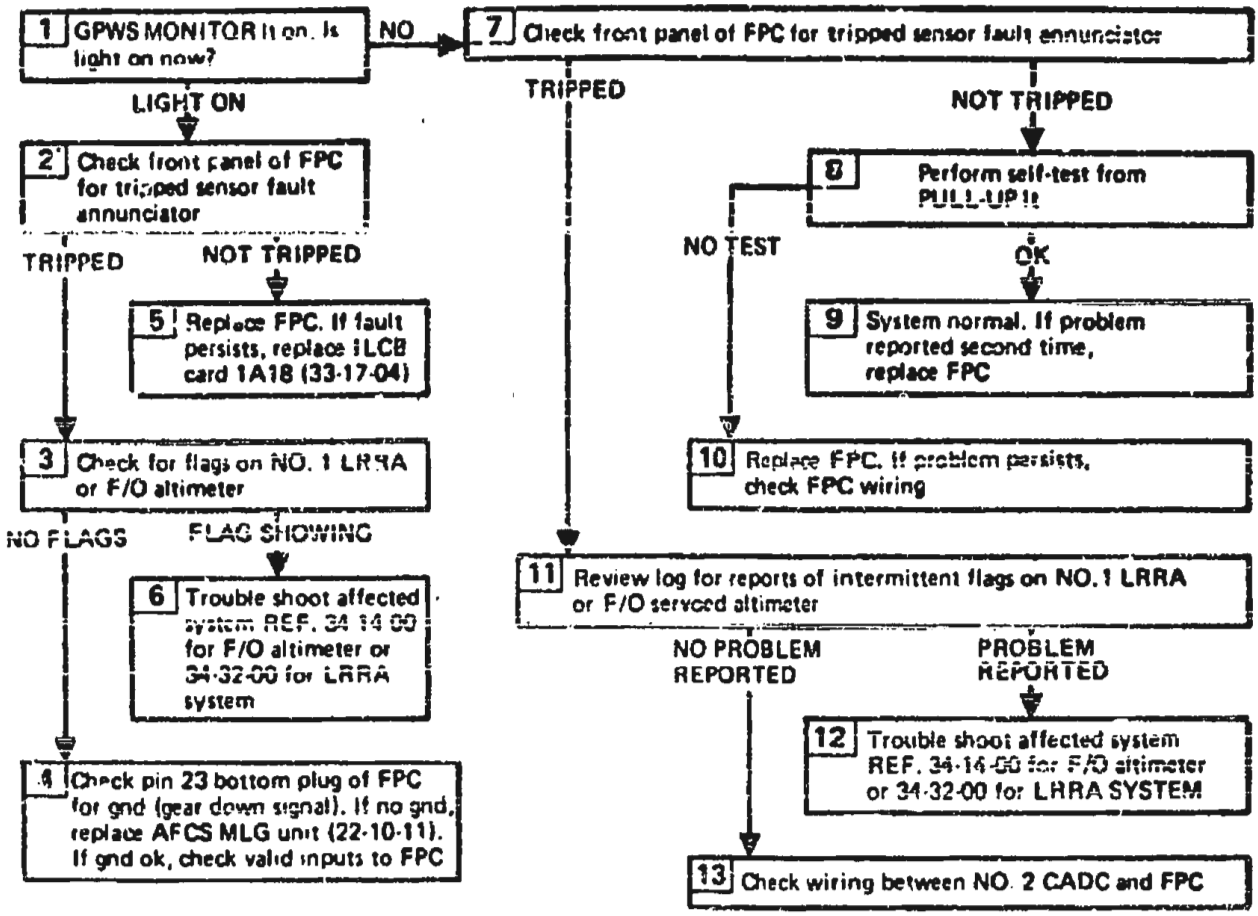
C
C

Component Locator Diagram
Figure 102

R
R
R

EFFECTIVITY: ALL

001B


1 GPWS MONITOR lt on. Is light on now?
NO
LIGHT ON
2 Check front panel of FPC for tripped sensor fault annunciator
TRIPPED
NOT TRIPPED
5 Replace FPC. If fault persists, replace ILCB card 1A18 (33-17-04)
3 Check for flags on NO. 1 LRRA or F/O altimeter
NO FLAGS
FLAG SHOWING
6 Trouble shoot affected system REF. 34-14-00 for F/O altimeter or 34-32-00 for LRRA system
4 Check pin 23 bottom plug of FPC for gnd (gear down signal). If no gnd, replace AFCS MLG unit (22-10-11). If gnd ok, check valid inputs to FPC
7 Check front panel of FPC for tripped sensor fault annunciator
TRIPPED
NOT TRIPPED
8 Perform self-test from PULL-UP !!
NO TEST
OK
9 System normal. If problem reported second time, replace FPC
10 Replace FPC. If problem persists, check FPC wiring
11 Review log for reports of intermittent flags on NO. 1 LRRA or F/O servoed altimeter
NO PROBLEM REPORTED
PROBLEM REPORTED
12 Trouble shoot affected system REF. 34-14-00 for F/O altimeter or 34-32-00 for LRRA SYSTEM
13 Check wiring between NO. 2 CADC and FPC

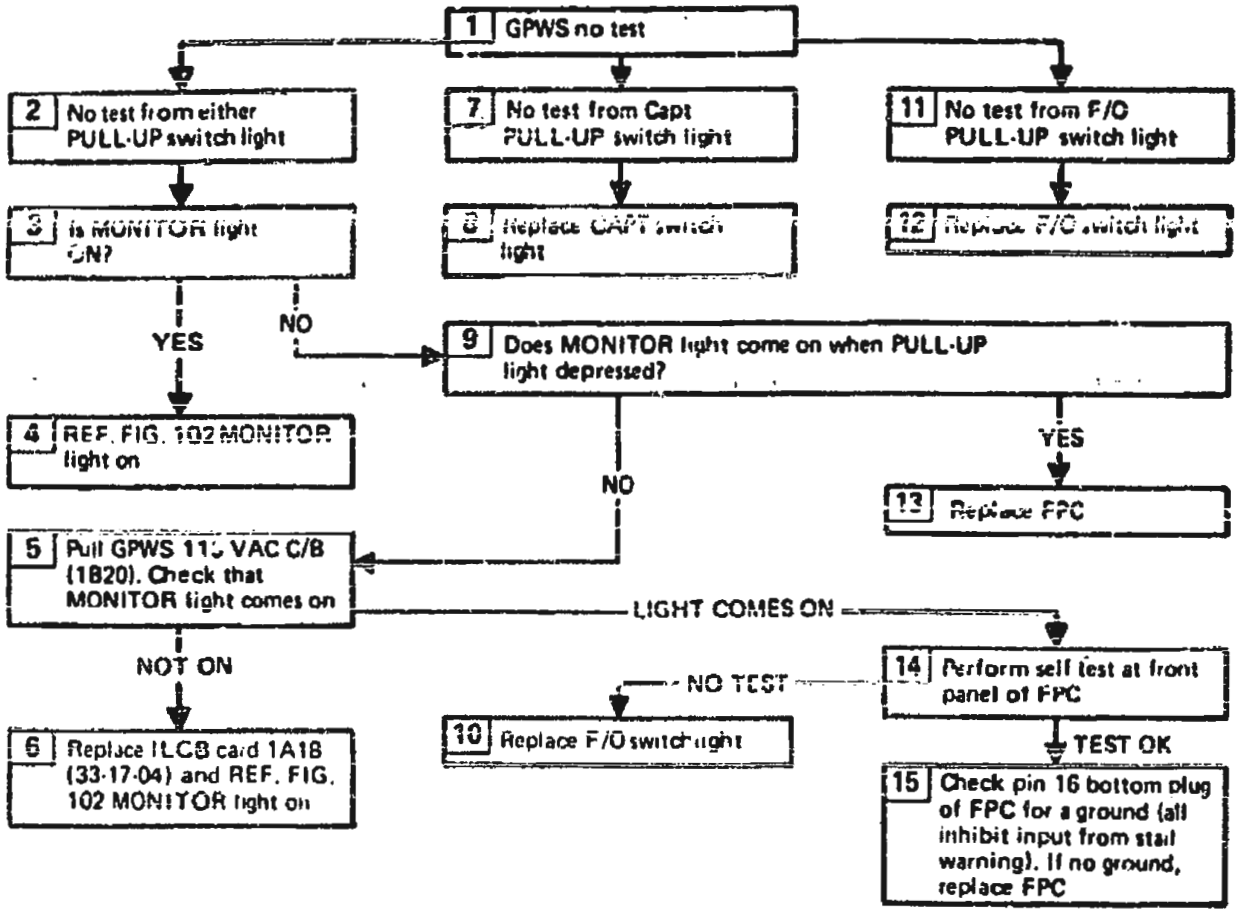
PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONICS AIR – FWD and MID LO FLO lights on FE/SO ECS MONITOR panel are out
CB's: 1B20, 1B21, 1D4, 1G27, 2H9, 2L8
Assure ESSENTIAL and NO. 2 switchlights on MASTER RADIO panel are on

M1-5000-34-2351

C
C GPWS MONITOR Light On
Figure 103

R EFFECTIVITY: ALL
R
0018


1 GPWS no test
2 No test from either PULL-UP switch light
7 No test from Capt PULL-UP switch light
11 No test from F/O PULL-UP switch light
3 Is MONITOR light ON?
8 Replace CAPT switch light
12 Replace F/O switch light
YES
NO
9 Does MONITOR light come on when PULL-UP light depressed?
4 REF. FIG. 102 MONITOR light on
YES
NO
13 Replace FPC
5 Pull GPWS 115 VAC C/B (1B20). Check that MONITOR light comes on
LIGHT COMES ON
NOT ON
14 Perform self test at front panel of FPC
NO TEST
10 Replace F/O switchlight
TEST OK
6 Replace ILCB card 1A18 (33-17-04) and REF. FIG. 102 MONITOR light on
15 Check pin 16 bottom plug of FPC for a ground (all inhibit input from stall warning). If no ground, replace FPC

PREREQUISITES

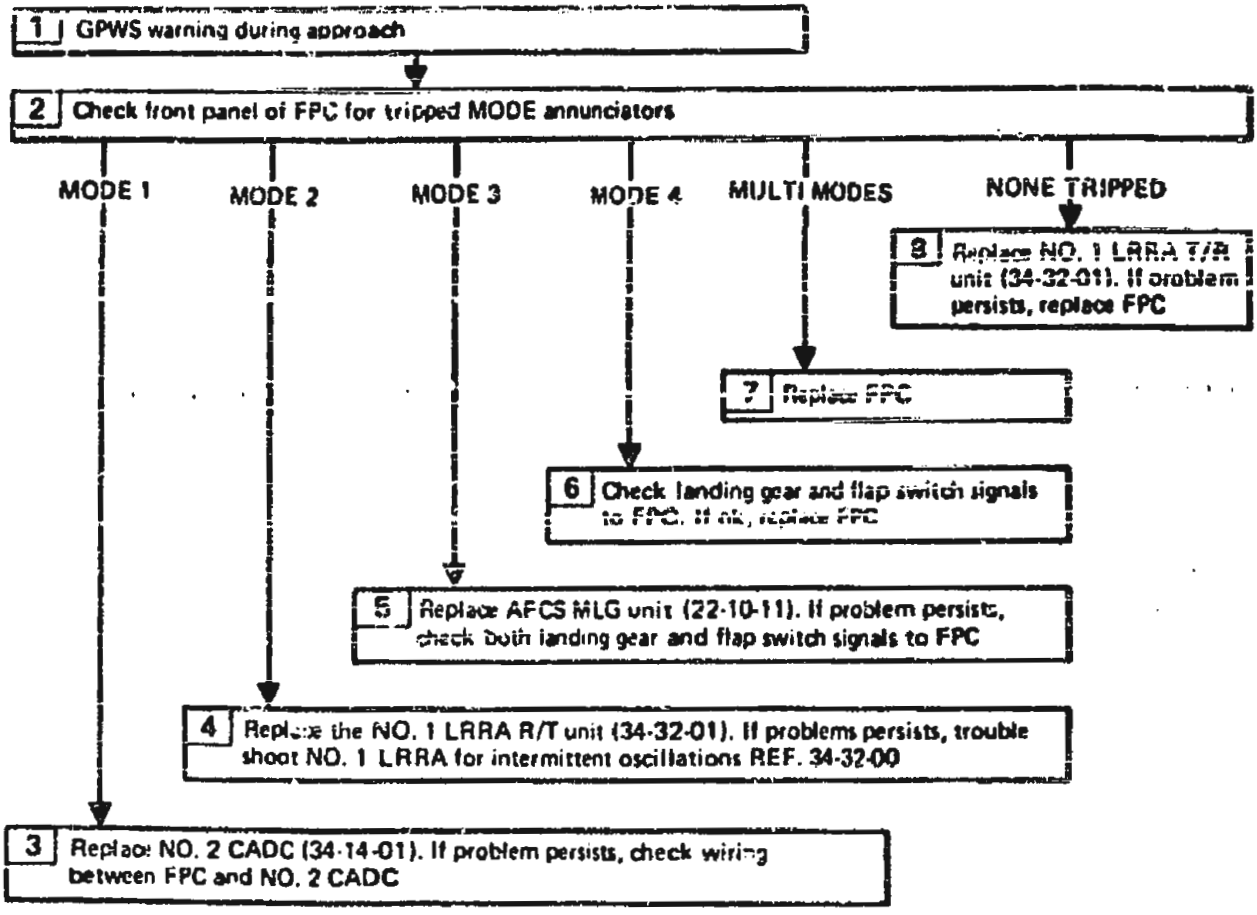
Elec Pwr (24-00-00)
Cooling: Verify AVIONICS AIR – FWD and MID LO FLO lights on FE/SO ECS MONITOR panel are out
CB's: 1B20, 1B21, 1D4, 1G27, 2H9, 2L8
Assure ESSENTIAL and NO. 2 switchlights on MASTER RADIO panel are on

M1-5000-34-2382

GPWS No Test
Figure 104

EFFECTIVITY: ALL

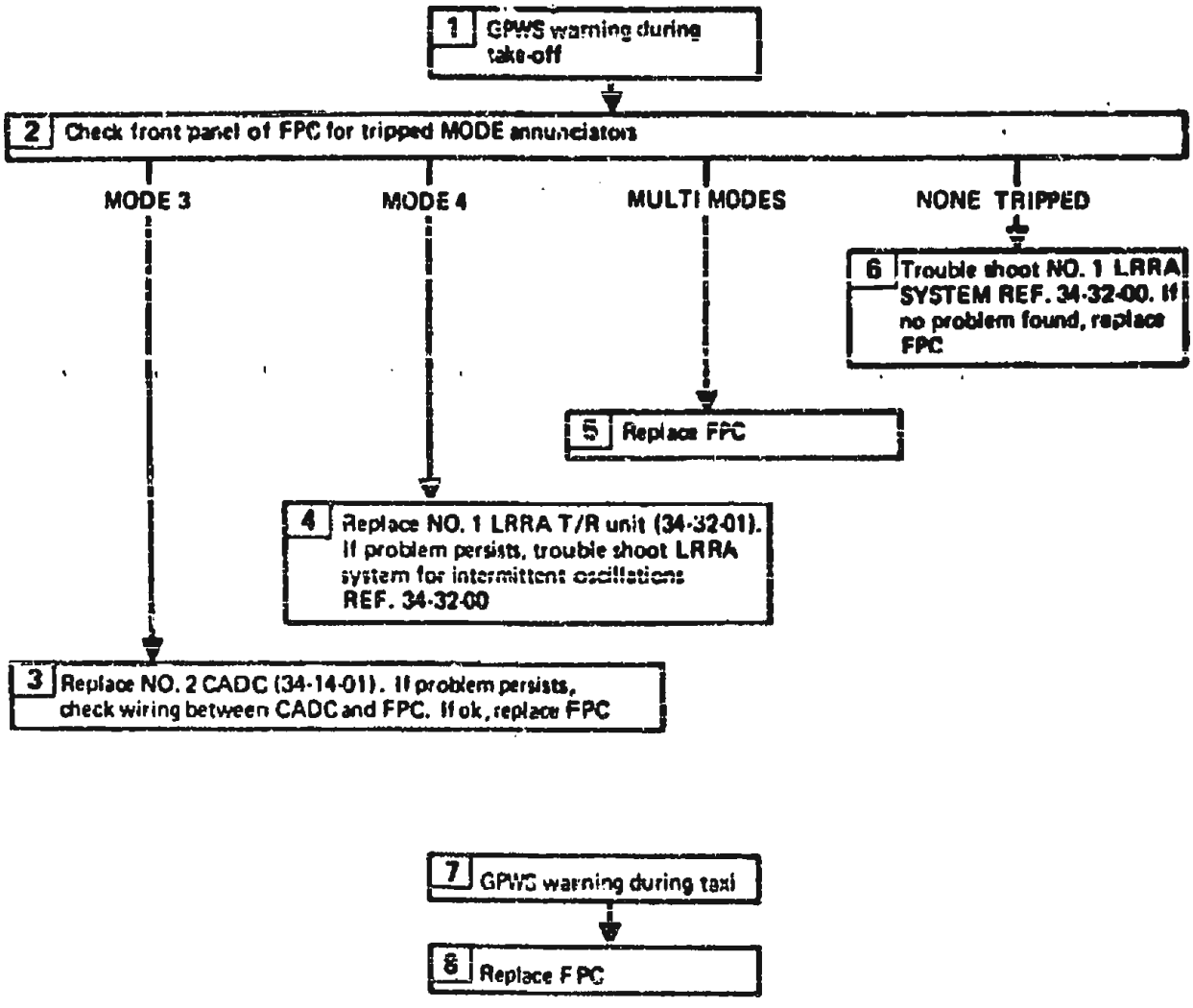
0018


1 GPWS warning during approach
2 Check front panel of FPC for tripped MODE annunciators
MODE 1
MODE 2
MODE 3
MODE 4
MULTI MODES
NONE TRIPPED
8 Replace NO. 1 LRRA T/R unit (34-32-01). If problem persists, replace FPC
7 Replace FPC
6 Check landing gear and flap switch signals to FPC. If ok, replace FPC
5 Replace AFCS MLG unit (22-10-11). If problem persists, check both landing gear and flap switch signals to FPC
4 Replace the NO. 1 LRRA R/T unit (34-32-01). If problems persists, trouble shoot NO. 1 LRRA for intermittent oscillations REF. 34-32-00
3 Replace NO. 2 CADC (34-14-01). If problem persists, check wiring between FPC and NO. 2 CADC

M1-5000-34-2353

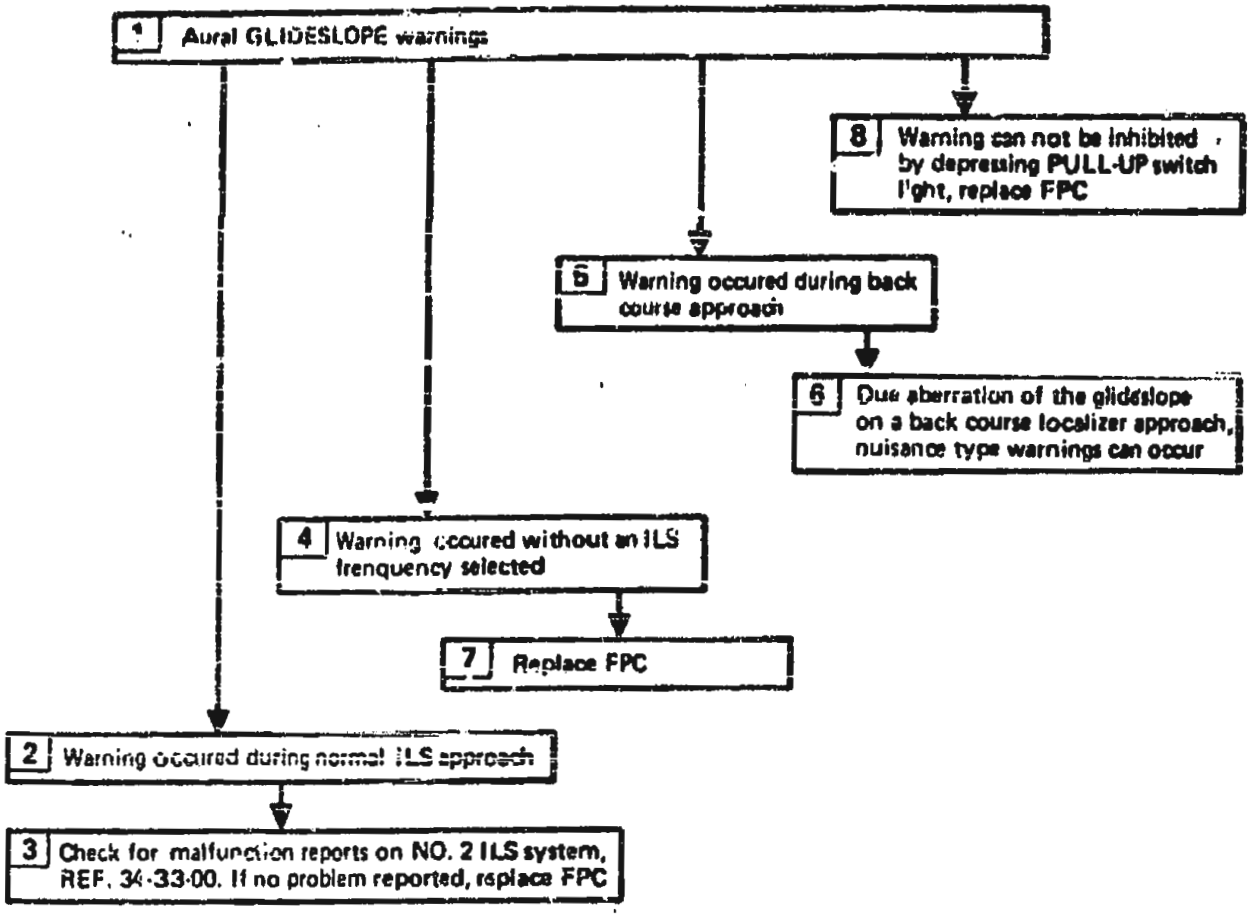
C
C GPWS Warning During Approach
Figure 105

R EFFECTIVITY: ALL
R
0018


1 GPWS warning during take-off
2 Check front panel of FPC for tripped MODE annunciators
MODE 3
MODE 4
MULTI MODES
NONE TRIPPED
6 Trouble shoot NO. 1 LRRA SYSTEM REF. 34-32-00. If no problem found, replace FPC
5 Replace FPC
4 Replace NO. 1 LRRA T/R unit (34-32-01). If problem persists, trouble shoot LRRA system for intermittent oscillations REF. 34-32-00
3 Replace NO. 2 CADC (34-14-01). If problem persists, check wiring between CADC and FPC. If ok, replace FPC
7 GPWS warning during taxi
8 Replace FPC

M1-9001-34-2354

C
C GPWS Warning During Taxi/Take-Off
Figure 106

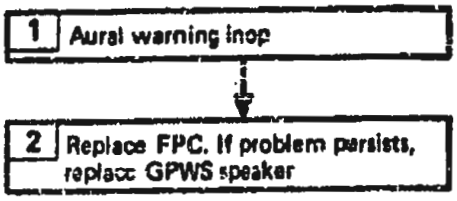

1 Aural GLIDESLOPE warnings
8 Warning can not be inhibited by depressing PULL-UP switch light, replace FPC
5 Warning occured during back course approach
6 Due aberration of the glideslope on a back course localizer approach, nuisance type warnings can occur
4 Warning occured without an ILS frenquency selected
7 Replace FPC
2 Warning occured during normal ILS approach
3 Check for malfunction reports on NO. 2 ILS system, REF. 34-33-00. If no problem reported, replace FPC

PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONICS AIR – FWD and MID LO FLO lights on FE/SO ECS MONITOR panel are out
CB's: 1B20, 1B21, 1D4, 1G27, 2H9, 2L8
Assure ESSENTIAL and NO. 2 switchlights on MASTER RADIO panel are on

Mi-5000-34-2356

Aural Glideslope Warnings
Figure 107



PREREQUISITES

Elec Pwr (24-00-00)
Cooling: Verify AVIONICS AIR – FWD and MID LO FLO lights on FE/SO ECS MONITOR panel are out
CB's: 1B20, 1B21, 1D4, 1G27, 2H9, 2L8
Assure ESSENTIAL and NO. 2 switchlights on MASTER RADIO PANEL are on

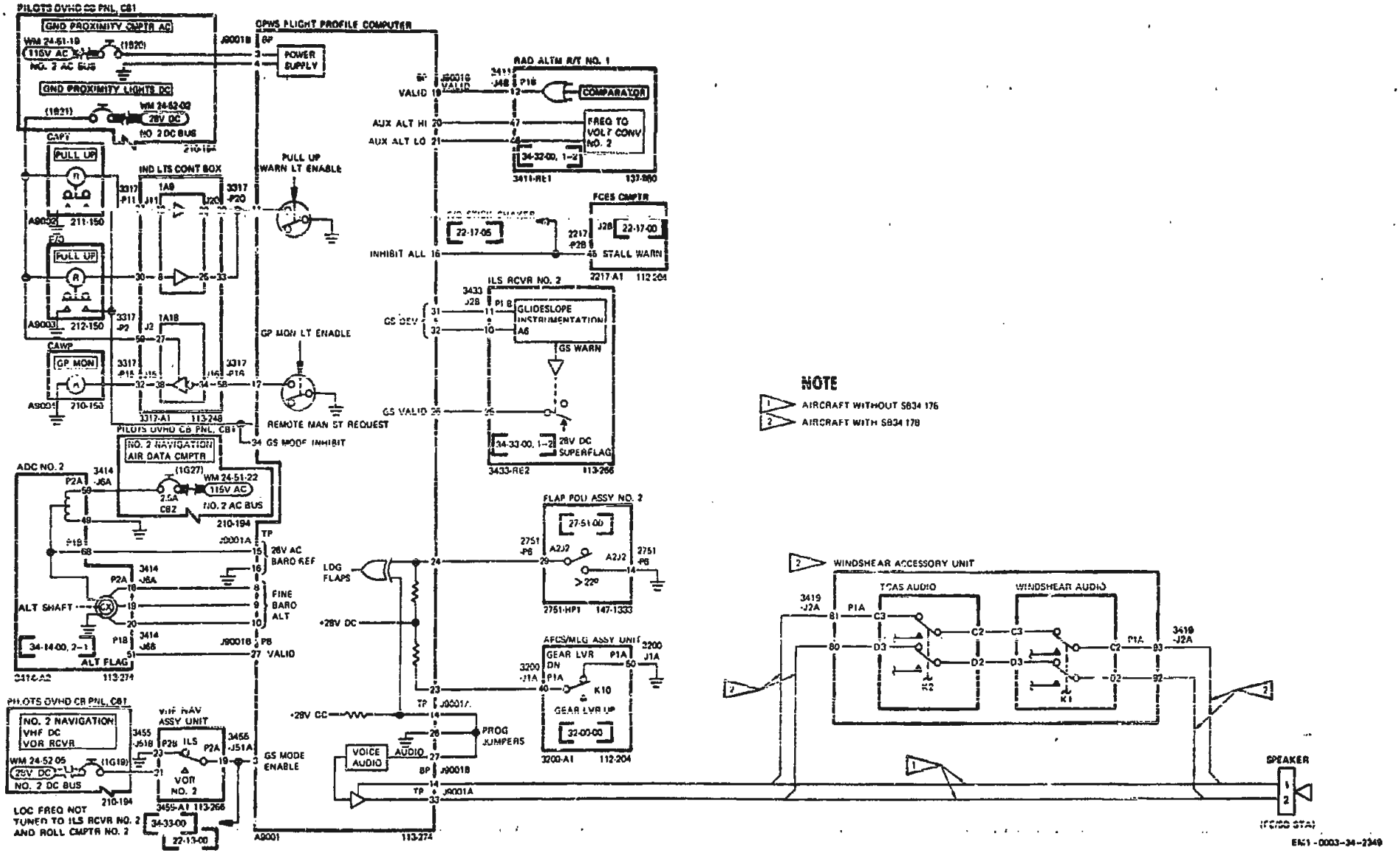
M1-5000-34-2258

C
C

Aural Warning Inop
Figure 108

R
R
001B

EFFECTIVITY: ALL



EM1-0003-34-2349

R Ground Proximity Warning System Schematic
R SCHEM 1

EFFECTIVITY: ALL

0018

CR GROUND PROXIMITY WARNING SYSTEM - ADJUSTMENT/TEST

CR 1. General

CR A. The following test procedures are intended to check out the CR overall function of the GPWS. Three types of tests are CR provided which permit limited as well as full range testing CR of this system.

CR (1) Operational Test

CR (a) This test provides a confidence test of the system CR utilizing on board equipment. Satisfactory CR completion of this test assures that the Flight CR Profile Comparator (FPC) responds to input signals CR and is without major internal failures.

CR (2) Functional Test

CR (a) This test is predicated on the successful CR completion of the operational test and provides a CR verification of all input and output interfaces, CR but does not test the accuracy of all modes of CR operation.

CR (3) System Test

CR (a) This test provides a complete system checkout for CR operation as well as accuracy, and normally will CR be performed only at overhaul maintenance periods CR or when sufficient maintenance is accomplished as CR to leave the integrity of the total system in CR doubt.

CR 2. Prepare To Test

CR A. Assure that the following circuit breakers are closed.

CR (1) GND PROXIMITY CMPTR AC, CB-1 panel B20.

CR (2) GND PROXIMITY LIGHTS DC, CB-1 panel B21.

CR (3) NO. 2 AIR DATA CMPTR, CB-1 panel G27.

CR (4) NO. 1 RADIO ALTM, CB-1 panel D4.

CR (5) MLG GND SENSE, CB-2 panel L8.

CR (6) PILOTS IND LT TEST 2, CB-2 panel H9.

C (7) FCES A/C & L-AOA, CB-1 panel B5.

C (8) R-AOA, CB-2 panel F1.

C (9) STICK SHAKER, CB-2 panel F2.

C B. Pull the following Circuit Breakers

C (1) FCES A/C and L-AOA, CB-1 panel B5.

C (2) R-AOA, CB-2 panel F1.

C C. Assure the ESSENTIAL and NO. 2 radio switches are turned ON.

CR (1) Assure STALL WARN switchlights are in.

C 3. Perform Operational Test

C A. Depress and hold PULL-UP switchlight on either Captain's or
C F/O's instrument panel, and the following should occur:

C (1) Both PULL-UP lights and GPWS MONITOR light should
C illuminate.

C (2) An aural warning consisting of two cycles of tone
C increasing in volume and frequency (WHOOP-WHOOP)
C followed by a voice warning saying PULL-UP, should be
C heard.

C (3) Both PULL-UP lights should go out but MONITOR light
C should stay illuminated.

C (4) A voice warning saying GLIDESLOPE should be heard.

C B. Warning sequence should repeat until test switch is
C released. All lights should go out and aural warning should
C stop when switchlight is released.

C 4. Functional Test Procedure

C A. Equipment Required

C (1) MB-1 Pitot/Static Tester R & R 90071 or Burton
C Pitot/Static Tester R & R 90084.

C (2) CRM-555 VOR/ILS Tester R & R 90150, or equivalent.

C (3) LRRA Tester R & R 90202.

C B. Prepare for Test

C (1) Set up the LRRA Tester as follows, and connect to the
C No. 1 radio altimeter R/T unit.

C (a) Set Test Select to AUX/IND ALTITUDE.

C (b) Set Aid/Alt Select to VARIABLE.

C (c) Set Altitude Standard on ZERO ALTITUDE.

C (d) Deleted

C (e) Adjust altitude control full COUNTERCLOCKWISE.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (2) Position trailing edge flaps UP.

C (3) Establish communication between cockpit, lower
C electronic compartment, and radio altimeter R/T
C location.

C (4) Connect pitot/static tester to the F/O's pitot/static
C systems. Seal F/O's static orifices on opposite side
C of aircraft.

C (5) Perform operational test.

C C. Perform Functional Test

C (1) Monitor Light Test

C (a) Pull GROUND PROXIMITY COMPUTER circuit breaker
C (B20) and observe that GPWS monitor light
C ILLUMINATES. Close circuit breaker and check that
C monitor light goes OUT.

C (b) Pull NO. 2 CADC circuit breaker (G27) and observe
C that GPWS MONITOR light ILLUMINATES in
C approximately 3 seconds. Close circuit breaker
C and check that monitor light goes OUT.

C (c) Pull the NO. 1 LRRA circuit breaker (D4). Observe
C that the GPWS monitor light ILLUMINATES in
C approximately 3 seconds. Close circuit breaker.
C Monitor light should go OUT.

C (2) Mode 1 - Excessive Descent Rate Test

C (a) Operate pitot/static tester to increase baro
C altitude to approximately 20,000 feet.

(b) Adjust altitude control on LRRA tester to maximum CLOCKWISE position.

(c) Adjust pitot/static tester to establish a 3000 feet per minute descent rate as read on the F/O's vertical speed indicator.

(d) Adjust altitude control on LRRA tester slowly COUNTERCLOCKWISE, do not exceed 1500 feet per minute, until a GPWS warning occurs. (Both PULL-UP lights illuminated and an aural warning of WHOOP-WHOOP PULL-UP.) Warning should occur between a maximum of 2000 feet and a minimum of 1000 feet.

(e) Altitude can be read on tester by using following procedure:

NOTE: A multiturn potentiometer is used in this circuit and numerous turns are required to move the meter pointer.

1) Set Meter Sens to LOW and adjust Altitude Standard to ZERO meter pointer.

2) Set Meter Sens to MED and adjust Altitude Standard to ZERO meter pointer.

3) Set Meter Sens to HIGH and adjust Altitude Standard to ZERO meter pointer.

4) Read Altitude off final Altitude Standard setting.

(f) Reduce baro altitude descent rate to zero feet per minute and warning should STOP.

(g) Reduce radio altitude to zero feet by adjusting altitude control on LRRA tester full COUNTERCLOCKWISE, adjust control slowly, do not exceed 1500 feet per minute.

NOTE: Warning will occur between 200 & 50 feet due to flap position.

(h) Re-establish baro altitude descent rate of 3000 feet per minute. Permit altitude to decrease to field elevation. No GPWS warning should occur.

(3) Mode 4 - Unsafe Terrain Clearance and Not in Landing Configuration.

C (a) Set Altitude Standard on 900 FEET, position Meter
C Sens to LOW, adjust altitude control CLOCKWISE to
C ZERO meter pointer.

C (b) In forward electronic service center, remove
C AFCS/MLG accessory unit from center rack.

C (c) Adjust altitude control slowly counterclockwise
C (do not exceed 1500 feet per minute) until a GPWS
C warning occurs. Warning should occur prior to 400
C feet. Use Altitude Standard and Meter Sens switch
C to zero meter on HIGH. Read altitude off Altitude
C Standard setting.

C (d) Reinstall the AFCS/MLG accessory unit. Warning
C should STOP.

C (e) Continue to adjust altitude control slowly
C COUNTERCLOCKWISE until GPWS warning RECURS.
C Warning should occur prior to 150 feet. Use
C Altitude Standard and Meter Sens switch to zero
C meter on HIGH. Read altitude off Altitude
C Standard setting.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (f) Position trailing edge flaps DOWN. The GPWS
C warning should STOP.

C (4) Mode 5 - Deviation Below Glideslope Test

C (a) Set Altitude Standard to 1100 feet, position Meter
C Sens to LOW, adjust Altitude Control CLOCKWISE to
C ZERO meter pointer.

C (b) Select ILS test frequency on No. 2 ILS control.
C Set glideslope tester to center the No. 2 ILS
C system glideslope needle.

C (c) Set Altitude Standard to 800 FEET, position Meter
C Sens to LOW, adjust Altitude Control COUNTER
C CLOCKWISE slowly (do not exceed 1500 feet per
C minute) to ZERO meter pointer.

C (d) Operate glideslope tester to cause the No. 2
C glideslope to deviate slowly in the FLY-UP
C direction. Between 1 and 2 dot deviation, an
C aural warning (a voice saying GLIDESLOPE) should
C be heard.

C (e) Depress either PULL-UP switchlight and warning should STOP.

C (f) Set Altitude Standard to 1200 FEET, position Meter Sens to LOW, adjust altitude control CLOCKWISE to ZERO meter pointer. Slowly adjust altitude control COUNTERCLOCKWISE (do not exceed 1500 feet per minute) until GLIDESLOPE aural warning is heard. Warning should occur at a maximum of 1150 feet and a minimum of 850 feet.

NOTE: Adjust Altitude Standard as outlined in Step 4.C.(2)(e) to read altitude.

C (g) Operate tester to center glideslope needle and warning should STOP.

C (h) Remove all test equipment.

C 5. System Test Procedure

C A. Equipment Required

C (1) MB-1 Pitot/Static Tester R & R 90071 or Burton Pitot/Static Tester R & R 90084.

C (2) CRM-555 VOR/ILS Tester R & R 90150, or equivalent.

C (3) Ground Proximity - Altitude Rate Generator Collins 860F-1.

C (4) LRRA Tester to R & R 90202.

C (5) Digital Voltmeter R & R 90203.

C B. Prepare for Test

C (1) Set up the LRRA Tester as follows, and connect to the No. 1 radio altimeter R/T unit.

C (a) Set Test Select to AUX/IND ALTITUDE.

C (b) Set Aid/Alt Select to VARIABLE.

C (c) Set Altitude Standard on ZERO ALTITUDE.

C (d) Deleted.

C (3) Adjust altitude control full COUNTERCLOCKWISE.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (2) Position trailing edge flaps UP.

C (3) Establish communication between cockpit, lower
C electronic compartment, and radio altimeter R/T
C location.

C (4) Adjust Altitude Standard on LRRA tester to 200 FEET.
C Set Meter Sens to LOW and adjust Altitude Control to
C ZERO meter point. Readjust Altitude Standard to ZERO
C altitude. Adjust altitude control to reduce altitude
C slowly to ZERO feet, by zeroing meter. Do not exceed
C 1500 feet per minute. Check that all mode annunciators
C and sensor fault annunciator on front panel of FPC show
C BLACK.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (5) Position trailing edge flaps full DOWN.

C (6) Connect pitot/static tester to the F/O's pitot/static
C systems. Seal F/O's static orifices on opposite side
C of aircraft.

C (7) Depress and hold self-test switch on front panel or
C FPC. Observe that FPC fault indicator on front panel
C comes ON and observe the following in the cockpit:

C (a) Both PULL-UP lights and GPWS MONITOR light
C illuminates.

C (b) An aural warning of WHOOP-WHOOP PULL-UP is heard.

C (c) Both PULL-UP lights go out but MONITOR light stays
C on.

C (d) A voice warning of GLIDESLOPE is heard.

C (8) Warning sequence should repeat until test switch is
C released.

C C. Perform System Test

C (1) Monitor Light Functional Test

C (a) Pull GROUND PROXIMITY COMPUTER circuit breaker
C (B20) and observe that GPWS monitor light
C ILLUMINATES. Close circuit breaker and check that
C monitor light goes OUT.

C (b) Pull NO. 2 CADC circuit breaker (G27) and observe that GPWS monitor light ILLUMINATES in approximately 3 seconds, and sensor fault annunciator on front panel of FPC trips in approximately 24 seconds. Close circuit breaker and check that monitor light goes OUT but sensor fault annunciator does not reset.

C (c) Depress self-test switch on front panel of FPC. The GPWS system should test and the sensor fault annunciator should reset.

C (d) Pull the NO. 1 LRRA circuit breaker (D4). Observe that the GPWS monitor light ILLUMINATES in approximately 3 seconds and sensor fault annunciator trips in approximately 24 seconds. Close circuit breaker. Monitor light should go OUT, but sensor ball does not reset.

C (e) Depress self-test switch on front panel of FPC. Sensor fault annunciator should RESET.

C (f) In forward electronic service center, remove AFCS/MLG accessory unit from center rack for a minimum of 45 seconds. Observe that GPWS MONITOR light ILLUMINATES in approximately 12 seconds and sensor fault annunciator trips in approximately 40 seconds.

C (g) Reinstall the AFCS/MLG accessory unit. GPWS MONITOR light should go OUT but sensor fault annunciator should not reset.

C (h) Depress self-test switch on front panel of FPC and sensor fault annunciator should RESET.

C (i) Set Altitude Standard of LRRA tester to 1000 FEET.

C NOTE: A multiturn potentiometer is used in this circuit and numerous turns are required to move the meter pointer.

C 1) Set Meter Sens to LOW and adjust altitude control to ZERO meter pointer.

C 2) Set Meter Sens to MED and adjust altitude control to ZERO meter pointer.

C 3) Set Meter Sens to HIGH and adjust altitude control to ZERO meter pointer.

(j) Depress either PULL-UP switchlight. Check that PULL-UP lights do not ILLUMINATE and no aural warning is heard.

(k) Adjust altitude control to maximum CLOCKWISE position.

(l) Depress either PULL-UP switchlight, observe that system self-tests as outlined in Step 5.B.(7).

(2) Mode 1 - Excessive Descent Rate Test

(a) Operate pitot/static tester to increase baro altitude to approximately 20,000 feet.

(b) Adjust pitot/static tester to establish a 3000 feet per minute descent rate as read on the P/O's vertical speed indicator.

(c) Adjust altitude control on LRRA tester slowly COUNTERCLOCKWISE, do not exceed 1500 feet per minute, until a GPWS warning occurs. (Both PULL-UP lights illuminated and an aural warning of WHOOP-WHOOP PULL-UP.) Warning should occur between a maximum of 2000 feet and a minimum of 1000 feet.

NOTE: Use Altitude Standard and Meter Sens switch to zero meter on HIGH sens. Read altitude off Altitude Standard setting.

(d) When warning occurs, the mode one annunciator on the front panel of the FPC should TRIP.

(e) Reduce baro altitude descent rate to ZERO feet per minute and warning should STOP.

(f) Reduce radio altitude to ZERO feet by adjusting altitude control on LRRA tester full COUNTERCLOCKWISE, adjust control slowly, do not exceed 1500 feet per minute.

(g) Re-establish baro altitude descent rate of 3000 feet per minute. Permit altitude to decrease to approximately 6000 feet above field elevation. No GPWS warning should occur.

(3) Mode 3 - Altitude Loss After Take-Off Test

CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

(a) Position trailing edge flaps UP.

C (b) After flaps are up, wait 12 seconds then adjust Altitude Standard on LRRA tester to 300 feet, then adjust altitude control clockwise using Meter Sens to ZERO meter on HIGH. The mode one annunciator on front panel of the FPC should RESET.

C (c) Operate pitot/static tester to increase baro altitude a small amount (100 feet or less). Record reading then start a slow descent, 100 feet per minute or less, until a GPWS warning occurs.

C (d) Stop baro altitude rate of descent when warning occurs. Baro altitude shall have decreased a minimum of 20 feet to a maximum of 60 feet below value recorded in Step (c) to cause warning.

C (e) When warning occurs, the mode three warning annunciator on front panel of FPC should TRIP.

C (f) Increase baro altitude above starting point and warning should STOP.

C (g) Set Altitude Standard on LRRA tester to 900 FEET. Adjust altitude control clockwise using Meter Sens to ZERO meter on HIGH. Operate pitot/static tester to reduce baro altitude to field elevation (do not exceed 1000 feet per minute). No GPWS warning shall OCCUR.

C (4) Mode 4 - Unsafe Terrain Clearance and Not in Landing Configuration

C (a) In forward electronic service center, remove AFCS/MLG accessory unit from center rack.

C (b) Adjust altitude control slowly COUNTERCLOCKWISE (do not exceed 1500 feet per minute) until a GPWS warning occurs. Warning should occur prior to 400 feet. Use Altitude Standard and Meter Sens switch to ZERO meter on HIGH. Read altitude off Altitude Standard setting.

C (c) When warning occurs, the mode 4 warning annunciator on front panel of FPC should TRIP.

C (d) Reinstall the AFCS/MLG accessory unit. Warning should STOP.

C (e) Continue to adjust altitude control slowly COUNTERCLOCKWISE until GPWS warning RECURS. Warning should occur prior to 150 feet. Use Altitude Standard and Meter Sens switch to zero

C meter on HIGH. Read altitude off Altitude
C Standard setting.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (f) Position trailing edge flaps DOWN. The GPWS
C warning should stop. Position trailing edge flaps
C UP.

CR (g) Operate pitot/static tester to decrease BARO
CR Altitude approximately 200 feet at a minimum of
CR 100 feet per minute and maximum of 500 feet per
CR minute.

CR (h) Adjust altitude control full COUNTERCLOCKWISE
C slowly. Wait a minimum of 12 seconds, then adjust
C clockwise until radio altimeter reads 150 feet.
C Both the mode 3 and 4 warning annunciators on
C front panel of FPC should RESET.

C (5) Mode 2 - Excessive Terrain Closure Rate Test

C (a) Disconnect LRRA tester from No1 1 Radio Altimeter
C R/T unit. Connect ground proximity altitude rate
C generator to No. 1 R/T unit.

C (b) Position Altitude Select switch to 2600 feet.

C (c) Turn power switch ON and operate initiate/slew
C switch to INITIATE position momentarily.

C (d) Connect digital voltmeter to DC altitude jacks.

C (e) Set rate control selector to 4000 feet per minute.

C (f) Position initiate/slew switch to SLEW position
C until a GPWS warning occurs then return switch to
C STOP position. Warning should occur at a maximum
C radio altitude of 2000 feet (24 volts DC on
C voltmeter) and before a minimum radio altitude of
C 1000 feet (17 volts DC).

C NOTE: When initiate/slew switch is returned to
C STOP position, the radio altimeter stops
C descending and GPWS warning should STOP.

C (g) When warning occurs, the mode 2 warning
C annunciator on the front panel of the FPC should
C TRIP.

C (h) Position rate control selector on tester to 1000 feet per minute, then position initiate/slew switch to SLEW position until voltmeter reads 0.4 volts DC or less, then return switch to STOP. Wait a minimum of 12 seconds then set altitude selector to 1100 feet, position initiate/slew switch to INITIATE position momentarily then return to STOP. Both the mode 2 and 4 mode annunciators on front panel of FPC should RESET.

NOTE: When altitude is decreasing to ZERO a GPWS warning will occur at approximately 200 feet and STOP at 50 feet.

(6) Mode 5 - Deviation Below Glideslope Test

CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

(a) Position the trailing edge flaps DOWN.

(b) Select ILS test frequency on NO. 2 ILS control. Set glideslope tester to center the No. 2 ILS system glideslope needle.

(c) Set altitude rate control on tester to 500 feet per minute. Position initiate/slew switch in SLEW position while observing voltmeter. When voltage has reduced to 15 volts, 800 feet Radio Altitude, return switch to STOP position.

(d) Operate glideslope tester to cause the No. 2 glideslope to deviate slowly in the FLY-UP direction. Between 1 and 2 dot deviation, an aural warning (a voice saying GLIDESLOPE) should be heard and the mode 5 annunciator on the front panel of the FPC should TRIP.

(e) Depress either PULL-UP switchlight and warning should STOP.

(f) Momentarily position initiate/slew switch on tester to the INITIATE position, then return to STOP.

(g) Position initiate/slew switch in the SLEW position until the GLIDESLOPE warning is heard then return switch to STOP. Warning should occur at a maximum radio altitude of 1150 feet (18.5 volts DC) and a minimum altitude of 850 feet (15.5 volts DC).

C (h) Operate tester to center glideslope needle and
C warning should STOP.

C (i) Operate tester to cause the No. 2 glideslope to
C deviate in a FLY-UP direction until warning
C RECURS.

C (j) Position initiate/slew switch on the tester in the
C SLEW position until voltmeter reads 0.4 volts DC
C or less, then return switch to STOP. As radio
C altitude decreases, the repetition rate of the
C GLIDESLOPE should increase. At approximately 300
C feet, the volume should increase and at
C approximately 100 feet, the warning should STOP.

C CAUTION: ENSURE THAT FLAPS ARE CLEAR AND ALL NECESSARY
C PERSONNEL SAFETY PRECAUTIONS ARE TAKEN.

C (k) Position the trailing edge flaps UP.

C (l) Wait a minimum of 12 seconds after flaps are up
C then position initiate/slew switch on tester to
C the INITIATE position momentarily then return to
C STOP. The mode 5 warning annunciator should
C RESET.

C (m) Remove all test equipment.

DEPENDENT POSITION DETERMINING - DESCRIPTION AND OPERATION

1. General

The dependent position determining systems are that portion of the navigation system which provides information to determine position, and is mainly dependent on ground installations. The dependent position determining systems and components are:

Distance Measuring Equipment (DME) (Ref. 34-51-00):

Radio digital distance magnetic indicator (RDDMI)

R Air Traffic Control Transponder System (ATC) (Ref. 34-53-00):

Transponder

ATC control panel

VHF Omnirange System (VOR) (Ref. 34-55-00):

VOR receiver

Horizontal situation indicator (HSI)

Radio digital distance magnetic indicator (RDDMI)

Automatic Direction Finder (ADF) (Ref. 34-57-00):

ADF receiver

ADF control panel

R Radio digital distance magnetic indicator (RDDMI).

The distance measuring equipment interfaces with the following systems: audio integrating (Ref. 23-51-00) and air traffic
R control transponder (Ref. 34-53-00).

The air traffic control transponder interfaces with the distance measuring equipment and the air data computer (Ref. 34-14-00).

The VHF omnirange system interfaces with the following systems: autoflight (AFCS) (Ref. 22-00-00), magnetic heading reference (Ref. 34-22-00), HSI (Ref. 34-55-00), and audio integrating (Ref. 23-51-00).

DISTANCE MEASURING EQUIPMENT (DME)- DESCRIPTION AND OPERATION

1. General

There are two independent DME systems installed in the aircraft (Ref. Fig. 1). Each system consists of a VHF NAV control panel (Ref. 34-55-00), an 860E-3 DME interrogator, an antenna, and a digital nautical mileage indication, displayed on the Captains and First Officers RDDMI (Ref. 34-57-00). Each DME system provides a station identification audio output signal to the audio distribution unit (Ref. 23-51-00). Each system provides line-of-sight distance measurement between a selected ground station and the aircraft.

The applicable DME system is energized and automatically set to the normal mode of operation when the NO. 1 NAVIGATION DME (D5) and/or the NO. 2 NAVIGATION DME (D23) circuit breaker(s) on the pilots overhead circuit breaker panel CB1, zone 210 are closed, and 115 volt, 400 Hz power is supplied to the applicable bus.

When a very high frequency omnidirectional and radio range (VOR) ground station frequency (108.00 to 117.95 MHz) is selected on the Captains (DME-1) or the First Officers (DME-2) VHF NAV control panel, the applicable interrogator transmits interrogation pulse pairs on the assigned beacon receiving frequency (Ref. Fig. 2). The ground station, on receiving the coded interrogation signal, replies on an associated beacon transmitting frequency. Beacon reply signals received by the applicable antenna (DME-1 or DME-2) are applied to the respective interrogator. The interrogator computes the elapsed time between interrogation and reply to determine the distance to the station. The measured distance is displayed on the Captains and First Officers RDDMI, as either DME-1 or DME-2 nautical mileage. The interrogator also provides the ground beacon Morse Code identification signal as an audio output. An identical audio output is provided by the applicable VOR receiver (VOR-1, or VOR-2, Ref. 34-55-00). Since the applicable VOR and DME systems are both automatically tuned to the same station by the VHF NAV control panel; Captains VHF NAV control panel for system No. 1 and First Officers VHF NAV control panel for system No. 2, positive identification of correct VOR/DME tuning is provided. Because the air traffic control transponders (ATC transponders, Ref. 34-53-00) operate in the same frequency band as the DME; simultaneous operation of either interrogator and either ATC transponder is prevented by suppression pulse output/input circuits.

The two interrogators are mounted in the rear rack of the forward electronics service center, zone 113. DME system number No. 1 is controlled by the Captains VHF NAV control panel,

located on the Captains glareshield, zone 211, and DME system number No. 2 is controlled by the First Officers VHF NAV control panel, located on the First Officers glareshield, zone 212. The antennas are mounted at the bottom-centerline of the aircraft; system number one antenna at FS 479, and system number two antenna at FS 659. The nautical mileage (slant range) digital readout is displayed on the Captains and First Officers RDDMI, located on the Captains and First Officers instrument panels, zones 211 and 212.

2. Operation

The VHF NAV control panels provide tuning and mode command signals to the respective interrogators. The frequency selector control sets the frequency indication displayed in the frequency indicator window and positions two, four-deck switches to electrically represent (2-out-of-5 code) the frequency displayed. The frequency indication displayed represents the VOR channel corresponding to the selected DME channel. The necessary frequency interpolation between the selected VOR operating frequency and the corresponding DME channel is accomplished by circuit board A9 within the applicable interrogator. When the VOR frequency indication displayed on the applicable VHF NAV control panel is 108.00, the frequency interpolation circuit within the applicable interrogator, programs the interrogator for DME channel 17 operation, ie; receive at 978 MHz, and transmit at 1041 MHz.

NOTE: The digit 1 (extreme left) is always displayed in the frequency indicator window, as the frequency range of the VOR system(s) is 108.00 to 117.95 MHz, representing DME channels 17 through 126.

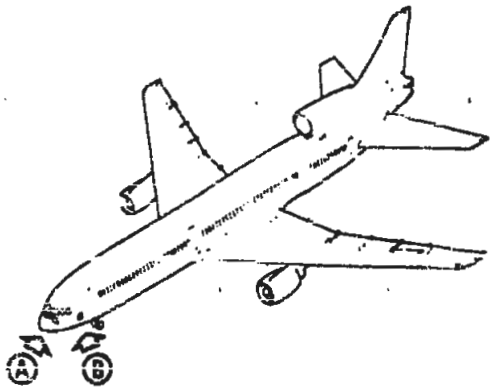
The DME mode selector switch controls the mode of operation of the applicable interrogator.

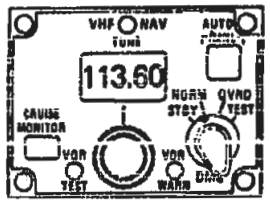
A. STBY

When the mode selector switch is set to STBY, the applicable interrogator-transmitter is inhibited and only the receiver is operative.

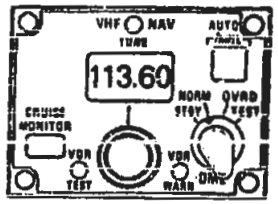
B. NORM

When the mode selector switch is set to NORM (normal) mode of operation, the transmitter is enabled, the interrogator transmits an interrogation pulse, and the range gate within the interrogator receiver circuit searches for a reply pulse from a range of 0 nautical miles out to a range of 200 nautical miles.





Ⓒ
CAPTAINS VHF NAV CONTROL PANEL
(DME SYSTEM NO. 1)



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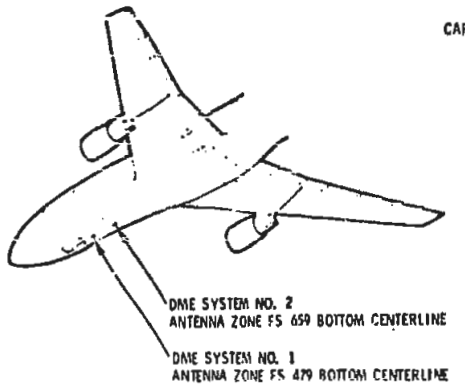
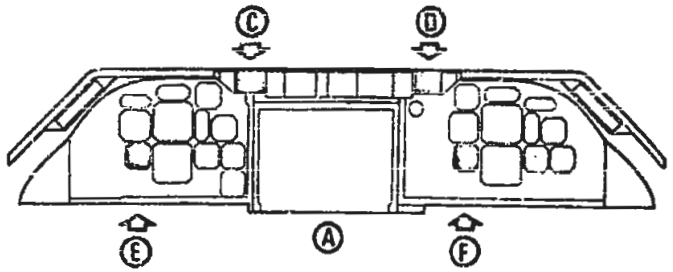
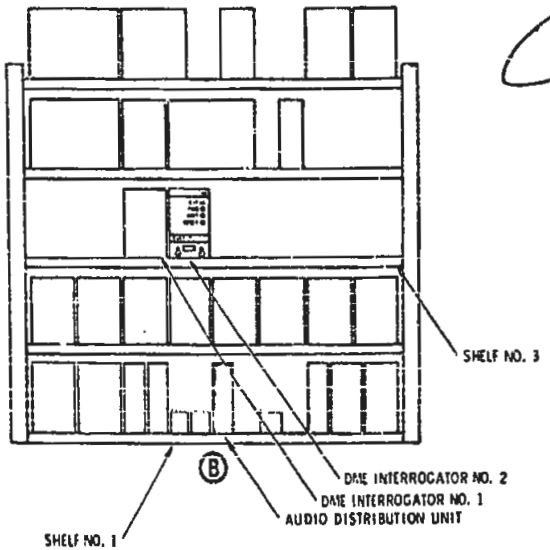
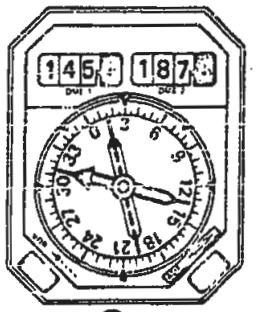
FIRST OFFICERS VHF NAV CONTROL PANEL
(DME SYSTEM NO. 2)





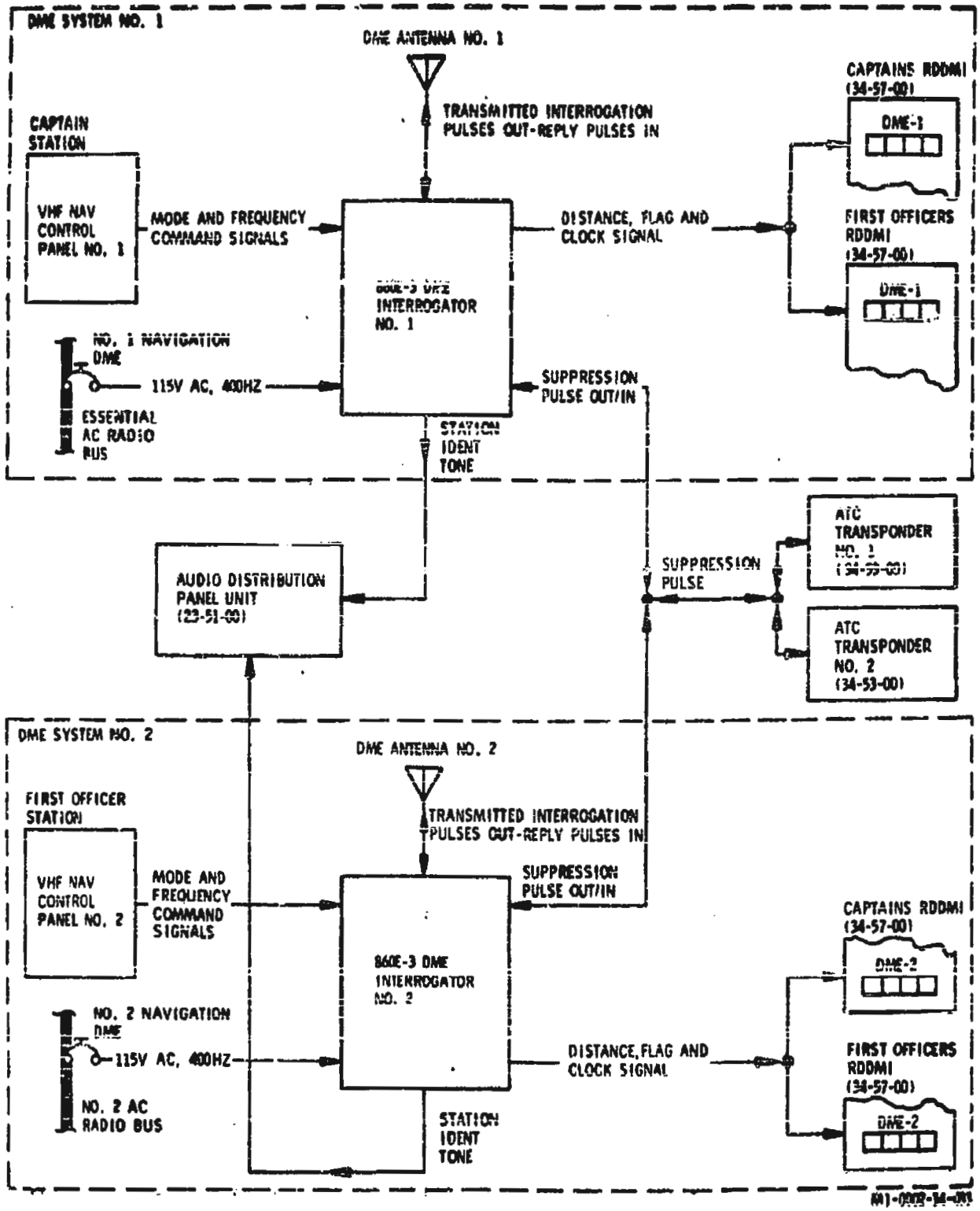




Ⓔ
CAPTAINS ROOM

Ⓕ
FIRST OFFICERS ROOM

DME System
Figure 1



DME System Block Diagram
Figure 2

EFFECTIVITY: ALL

C. OVRD

When the mode selector switch is set to OVRD (override) the range gate in the interrogator receiver circuit is enabled to search for a reply pulse out to 390 nautical miles.

D. TEST

R When the mode selector switch is momentarily set to the TEST
R position (spring-loaded, normally open); a test circuit in
R the applicable interrogator is enabled, which causes a 0
R nautical mile simulated range signal to be generated within
R the interrogator under test, and to be displayed on the
R Captains and First Officers RDDMI. When all circuits within the interrogator under test are operating correctly, the nautical mileage readout indication will be 000.0 (+0.1, -0.0). The test sequence as displayed on the RDDMI (DME-1 or DME-2) is; flag (Shutter) for one second, followed by four dashes for one second, then 000.0 (+0.1, -0.0) nautical mile indication.

3. 860E-3 DME Interrogator

A. Description

The 860E-3 DME Interrogator consists of 12 circuit card/modules (subassemblies) and a chassis, housed in an ARINC 1/2 ATR case.

The interrogator is provided with the following maintenance aids:

(1) There are three fault indicators on the front panel (R/T, IND, and ANT). Only the R/T is operational. This indicator is normally black and will turn to yellow when a fault occurs.

NOTE: The R/T fault indicator is reset by grounding test jack A1J4. Access to A1J4 is provided through a hole in the right panel of the case.

(2) Three fault indicators on subassembly A1A2 (Monitor) are used in conjunction with the front panel R/T fault indicator to indicate the status of eight functional circuits within the interrogator. These fault indicators are viewed through a slot in the right panel of the case. A table is printed on the backside of the right panel of the case, providing interpretation of fault indications using the three fault indicators.

NOTE: The fault indicators on A1A2 are reset by grounding A1J4.

R (3) Test jacks are provided on the bottom, right side of each subassembly for measurement purposes. The signal nomenclature for each test jack is printed on the backside of the right panel of the case.

(4) An ATE (automatic test equipment) connector is provided on the rear of the case, and may be used for manual troubleshooting.

The function of the 12 subassemblies mounted on the chassis is delineated in Table 1.

860E-3 DME Interrogator Subassemblies
Table 1

SUBASSEMBLY	FUNCTION
Monitor A1	1. Continuously monitors operation of interrogator circuits, and provides circuit malfunction indications on binary coded fault indicators. 2. Provides outputs to drive front panel fault indicators.
Distance Subassemblies A2, A3, and A4	1. Provides timing of DME interrogations. 2. Develops clock signal. 3. Measures time difference between interrogation and valid reply pulses. 4. Converts time difference to distance data in BCD format. 5. Develops analog distance, suppressor, and range rate outputs. 6. Provides memory function making possible updating mileage readout indication during loss of valid data. 7. Provides composite video signal for use in identification circuit.

860E-3 DME Interrogator Subassemblies (Cont)
Table 1

SUBASSEMBLY	FUNCTION
Decoder A5	1. Detects valid received pulse pairs. Produces a video pulse for each valid pulse pair. 2. Provides AGC to receiver.
Receiver A6	1. Develops tuning voltage for use in frequency synthesizer and L-band receiver. 2. Contains L-band receiver and IF circuits that develop video output for use in decoder.
Synthesizer Driver A7	Generates applicable receiver injection signal and transmitter drive signal for each channel selected.
Transmitter - Modulator A8	Receives RF from synthesizer driver A7 and generates high power RF interrogation pulses for application to diplexer A11.
Control/Ident A9	1. Converts 2-out-of-5 frequency select inputs into BCD. 2. Develops audio identification tone for application to aircraft audio distribution unit (Ref. 23-51-00).
Control A10	1. Amplifies analog data, suppressor, range rate, and in-test annunciate signals to ARINC levels. 2. Develops clock signal, data sync signal, and serial BCD distance output signals.
Diplexer A11	Maintains separation of transmitted and received signals.
Power Supply A12	Develops dc voltages from 115V ac, 400 Hz power.

B. Operation

Measurement of the slant range distance from the aircraft to a VOR/DME ground station begins with selection of the ground station VOR frequency on the VHF NAV control panel (Ref.

Fig. 3). The resulting 2-out-of-5 code output from the frequency selector switch on the VHF NAV control panel is applied to subassembly A9A1. The 2-out-of-5 code signals are buffered and converted to BCD frequency information by A9A1. This BCD output is applied to subassemblies A6, A7, and A10. Subassembly A10 decodes the BCD frequency information to indicate which of four possible frequency bands has been selected.

The BCD frequency information from A9 and the frequency band information from A10 are used to set the frequency of the frequency synthesizer output signal. The frequency synthesizer output is applied to the driver; where it is amplified, multiplied, and pulse modulated. The pulses used to modulate the RF are also applied to the driver from A3.

The driver output is applied to the transmitter section of A8. The modulator circuit in A8 receives low-level trigger pulses from A3 and synchronously generates high-level shaped pulses to modulate the transmitter. When the transmitter is modulated, it applies L-band RF to A11. Diplexer A11 provides the necessary separation between the transmitted and received signals.

Received RF pulses are applied from A11 to the L-band receiver circuits in A6. The receiver RF circuit also receives tuning voltage from the D/A converter in A6. This tuning voltage is developed from BCD frequency information applied from A9A1 to A6 and frequency band information applied from A10 to A6. The tuning voltage is used to set (tune) the receiver preselector to the correct receive frequency for the channel selected. The tuning voltage is also applied to the frequency synthesizer where it is used to tune the output circuits.

The detected IF output from A6 consists of video pulses. These video pulses are applied to A5. Decoder A5 distinguishes between valid and invalid reply pulses, accepting only valid reply pulses. An AGC voltage is also developed in A5 and applied to the receiver IF and RF circuits.

The decoded video pulses are applied from A5 to distance subassemblies A2, A3, and A4. The distance subassemblies measure the time between the leading edge of the first pulse in an interrogation, and the leading edge of the first pulse in a distance reply. The time measurement is converted to a BCD word bit output. Analog distance and range rate outputs are also developed in the distance subassemblies. The analog distance output consists of a pair of pulses separated by a time interval representing the distance measurement. The range rate output consists of a series of

pulses; one pulse applied for each 0.01 nautical mile change in distance. Both the analog distance output and the range rate output are applied to the Captains and First Officers RDDMI. A suppressor signal output is developed for use by the other DME system and by the ATC transponders when interrogation pulses are being transmitted. A composite video signal is also developed and applied to A9A2. This signal is used by A9A2 to develop the station identification signal that is applied to the aircraft audio distribution unit.

The BCD distance word bits, suppression pulses, analog distance, and range rate output signals are applied from the distance subassemblies to A10.

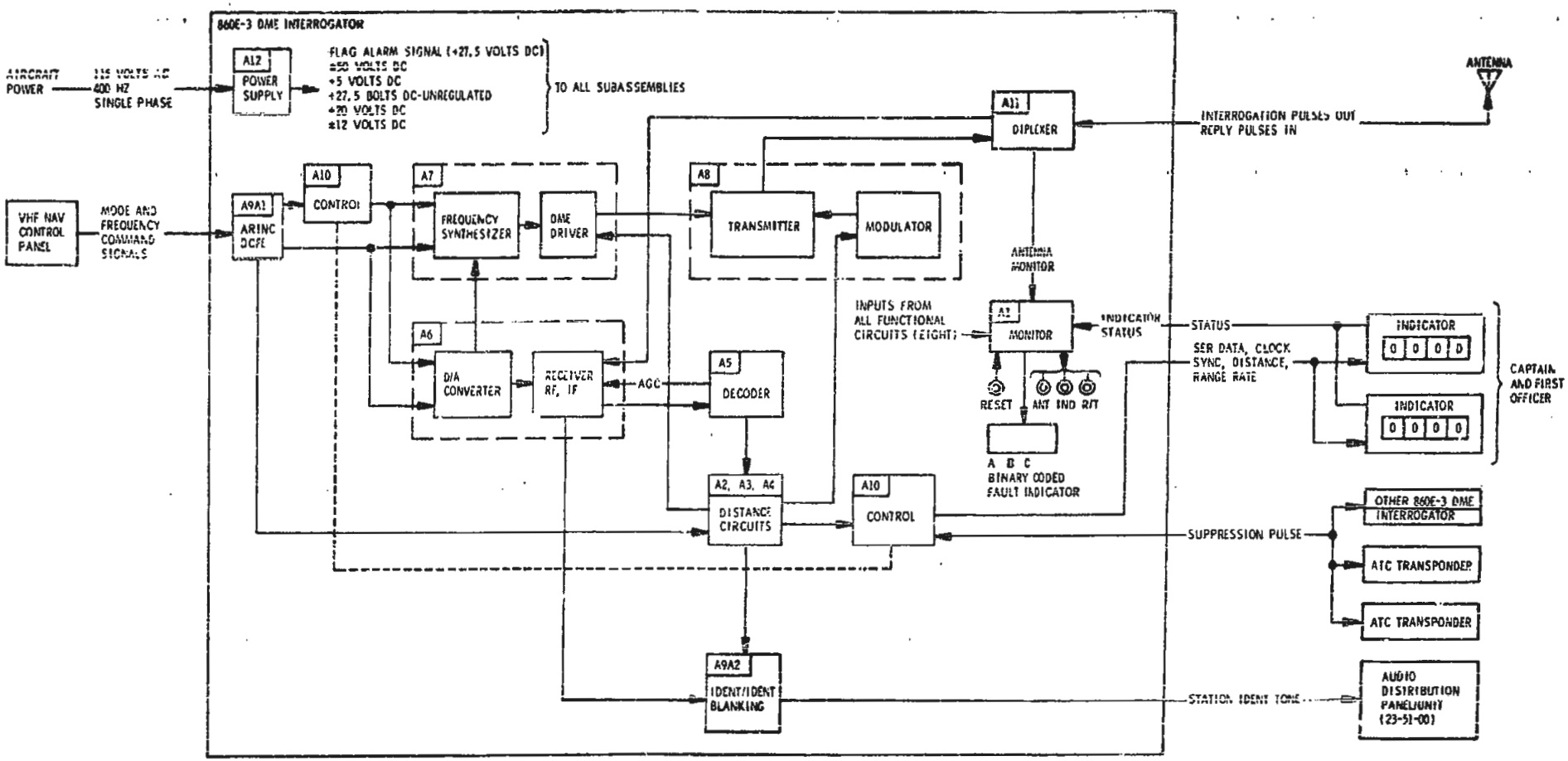
Control A10 synchronizes and amplifies the distance data into a serial BCD word that is applied to the Captains and First officers RDDMI. A data clock signal and word sync signal are also generated by A10 and applied to the Captains and First Officers RDDMI. The suppression pulse output is amplified by A10 and applied to the other DME interrogator and to the ATC transponders.

Subassembly A1 provides the monitor circuits that fault monitor the interrogator circuits. A binary coded fault indicator on A1 provides indications to enable isolation of faulty circuits in the interrogator. This indicator, one of three, is used in conjunction with the front panel R/T indicator to provide a status indication of eight functional circuits within the interrogator.

Monitor A1 also provides the necessary amplifier circuits used to drive the front panel fault indicators. The front panel fault indicators are of the magnetic latching type (once set, they must be reset to remove the fault indication). Only the R/T fault indication is operational.

Monitor A1 also provides the flag (shutter) output signal. The flag signal (27.5V dc) causes the flag alarm circuit in the Captains and First Officers RDDMI to coverup the nautical mileage indication windows with a shutter.

The interrogator is provided with a self-test (functional test) capability. The self-test circuit is enabled by momentarily setting the DME mode selector switch to TEST position on the VHF NAV control panel. When in the TEST position; a ground is applied to A9A1, which in turn applies a functional test enable signal to distance subassemblies A2, A3, and A4. The distance subassemblies develop a synthetic reply pulse spaced to represent a distance of 0 nautical mile. The distance subassemblies measure the time between the interrogation and self-test reply pulse;



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R 860E-3 DME Interrogator Block Diagram
R Figure 3

EFFECTIVITY: ALL

001B

applying the appropriate distance signal to A10. Control A10 develops the serial BCD word that is applied to the Captains and First Officers RDDMI. The self-test indications displayed in the nautical mileage digital readout windows on the RDDMI are; flag (shutter) for one second, followed by 4 dashes for one second, followed by a 000.0(+0.1,-0.0) nautical mile indication.

4. DME Antenna

A. Description

The L-band antenna is two inches high, with a 5-1/4 inch long base. It is a blade-type antenna secured to the aircraft with mounting screws. Electrical connection to the antenna is made using a type-N coaxial connector located on the bottom of the antenna base. The coaxial connection is weather-proofed by an O-ring located in a groove surrounding the coaxial connector.

B. Operation

The antenna operates within the frequency range of 970 to 1220 MHz and has a VSWR of 1.7 to 1 over the operating range.

NOTE: When operating in the frequency range of 1000 to 1100 MHz, the antenna has a VSWR of less than 1.42 to 1.

The antenna has a 50 ohm input impedance. It is vertically polarized and radiates and receives in an omnidirectional pattern.

DISTANCE MEASURING EQUIPMENT (DME) - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at top of each fault isolation diagram must
R be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on using fault code diagram or
R schematic.

R If flight crew reports a trouble using a fault code, the code
R can be found in 34 Fault Code Index. The index specifies
R maintenance manual section, fault isolation diagram, and block
R number on diagram where fault isolation procedure should start.
R Schematics are included at end of section to supplement fault
R isolation diagrams or as an aid in isolating a problem not
R covered on diagrams.

R Refer to Maintenance Manual Introduction for more detailed
R discussion of Fault Isolation Reporting Method (FIRM) and use of
R fault isolation diagrams/schematics.

R Since no fault isolation reporting system can cover every
R failure symptom, system functional schematics are provided
R giving information for intercomponent signal tracing from source
R to termination.

R To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
R Cross Reference (WM DIA CROSS REF) table on system functional
R schematics, listing applicable wiring diagram in L-1011 Wiring
Diagram Manual.

2. Equipment and Materials

C Tel-Instrument T-24A DME/ESI Tester - TWA R&R 90215

R NOTE: Test set required if procedures in Figure 104 are to be performed.

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide component locations for ATC system.

Fault Isolation Diagrams and Schematics List
Table 101

	FIGURE NUMBER	TITLE
	101	Component Location Index
	102	Component Locator Diagram
R	103	BITE
R	104	System Test
	105	DME System Problems
	SCHEM 1 (Sheet 1)	DME System Schematic (VHF NAV Control Panels)
	SCHEM 1 (Sheet 2)	DME System Schematic (DMEs)
	SCHEM 1 (Sheet 3)	DME System Schematic (Interface)

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA - DME	2	FUSELAGE BOTTOM	34-51-02
INDICATOR - RADIO DIGITAL DISTANCE MAGNETIC (RDDMI)	2	FLT STA, CAPT, AND F/O; INSTR PNL	34-57-08
INTERROGATOR - DME	2	FESC, REAR RACK/112AB	34-51-01
PANEL - VHF NAV CONTROL	2	FLT STA GLRSHLD PNL	34-55-02

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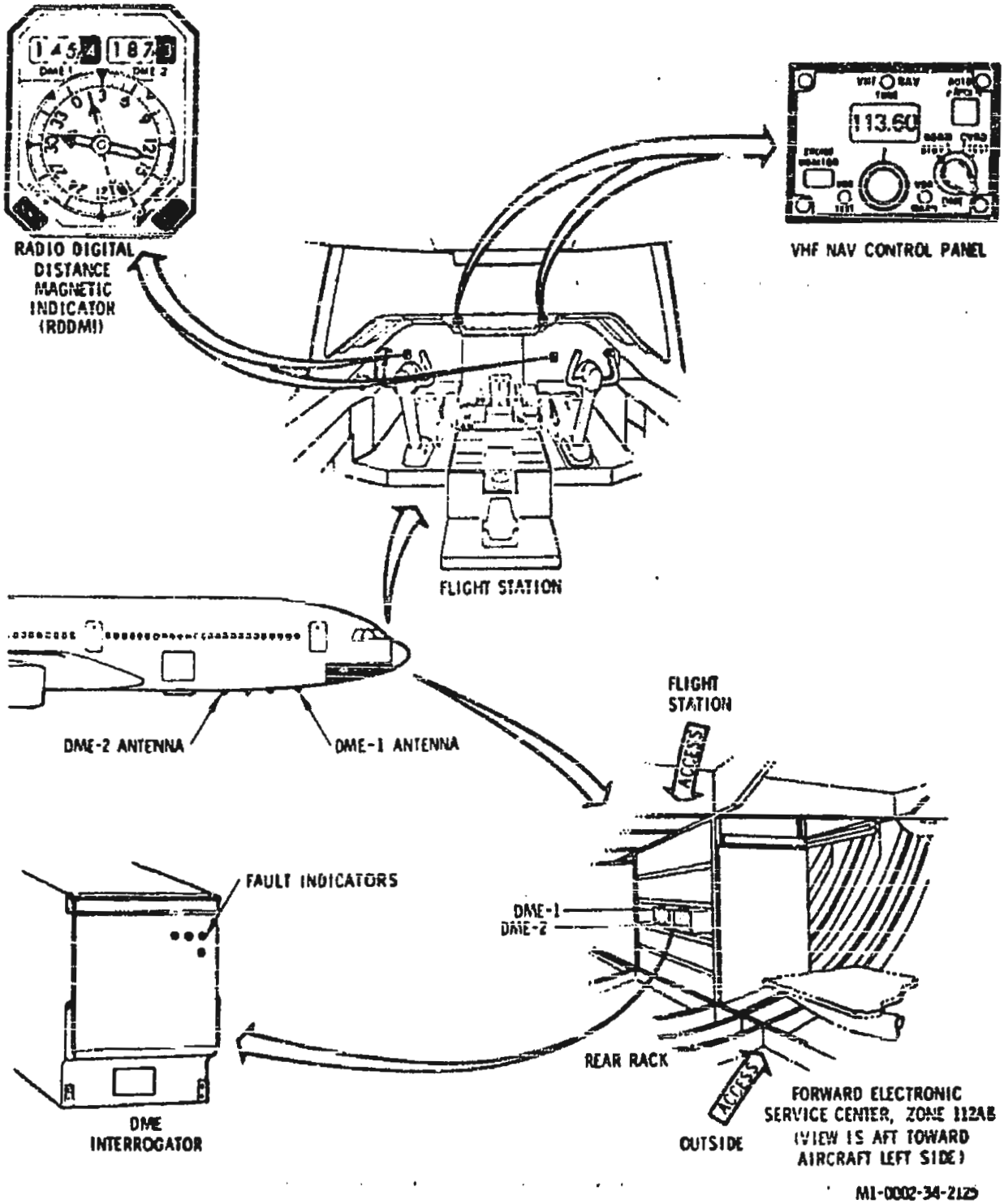
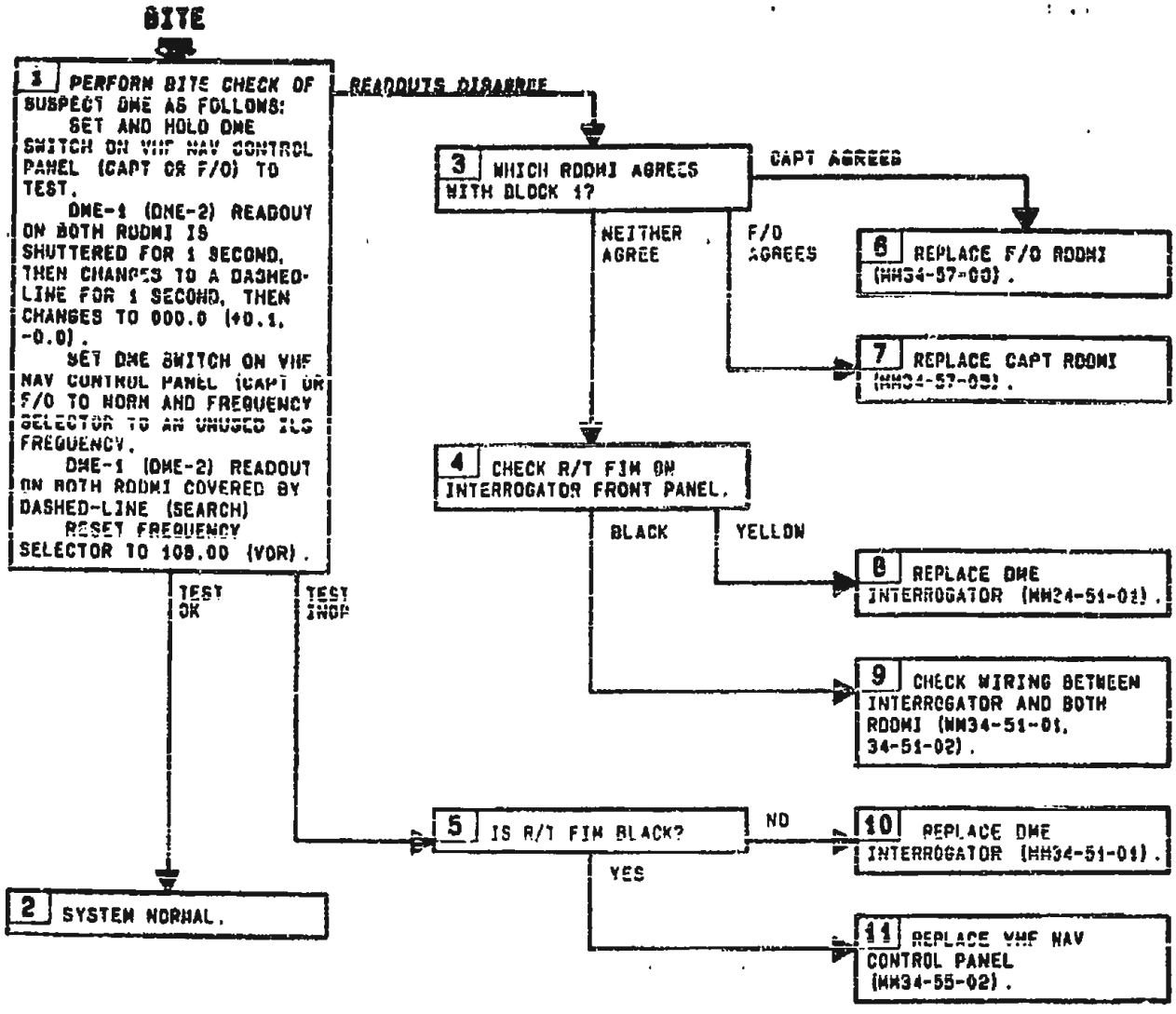
Component Location Index
Figure 101



DME System Component Locator
Figure 102

PREREQUISITES
ELECTRICAL POWER (MM24-00-00).
COOLING (MM21-26-00).
CB'S, 1D5, 1D23, 1E3, 1ER6, 1B1, 1B18.
VHF NAV CONTROL PANEL FOR SYSTEM UNDER TEST SET TO 108.00.


BITE
1 PERFORM BITE CHECK OF SUSPECT DME AS FOLLOWS:
SET AND HOLD DME SWITCH ON VHF NAV CONTROL PANEL (CAPT OR F/O) TO TEST.
DME-1 (DME-2) READOUT ON BOTH RDDMI IS SHUTTERED FOR 1 SECOND, THEN CHANGES TO A DASHED-LINE FOR 1 SECOND, THEN CHANGES TO 000.0 (+0.1, -0.0).
SET DME SWITCH ON VHF NAV CONTROL PANEL (CAPT OR F/O TO NORM AND FREQUENCY SELECTOR TO AN UNUSED ILS FREQUENCY.
DME-1 (DME-2) READOUT ON BOTH RDDMI COVERED BY DASHED-LINE (SEARCH)
RESET FREQUENCY SELECTOR TO 108.00 (VOR).
READOUTS DISAGREE
TEST OK
TEST INOP
2 SYSTEM NORMAL.
3 WHICH RDDMI AGREES WITH BLOCK 1?
CAPT AGREES
NEITHER AGREE
F/O AGREES
6 REPLACE F/O RDDMI (MM34-57-00).
7 REPLACE CAPT RDDMI (MM34-57-00).
4 CHECK R/T FIM ON INTERROGATOR FRONT PANEL.
BLACK
YELLOW
8 REPLACE DME INTERROGATOR (MM24-51-01).
9 CHECK WIRING BETWEEN INTERROGATOR AND BOTH RDDMI (MM34-51-01, 34-51-02).
5 IS R/T FIM BLACK?
NO
10 REPLACE DME INTERROGATOR (MM34-51-01).
YES
11 REPLACE VHF NAV CONTROL PANEL (MM34-55-02).

NOTE
ANT AND IND FIMS NOT OPERATIONAL.

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R
R

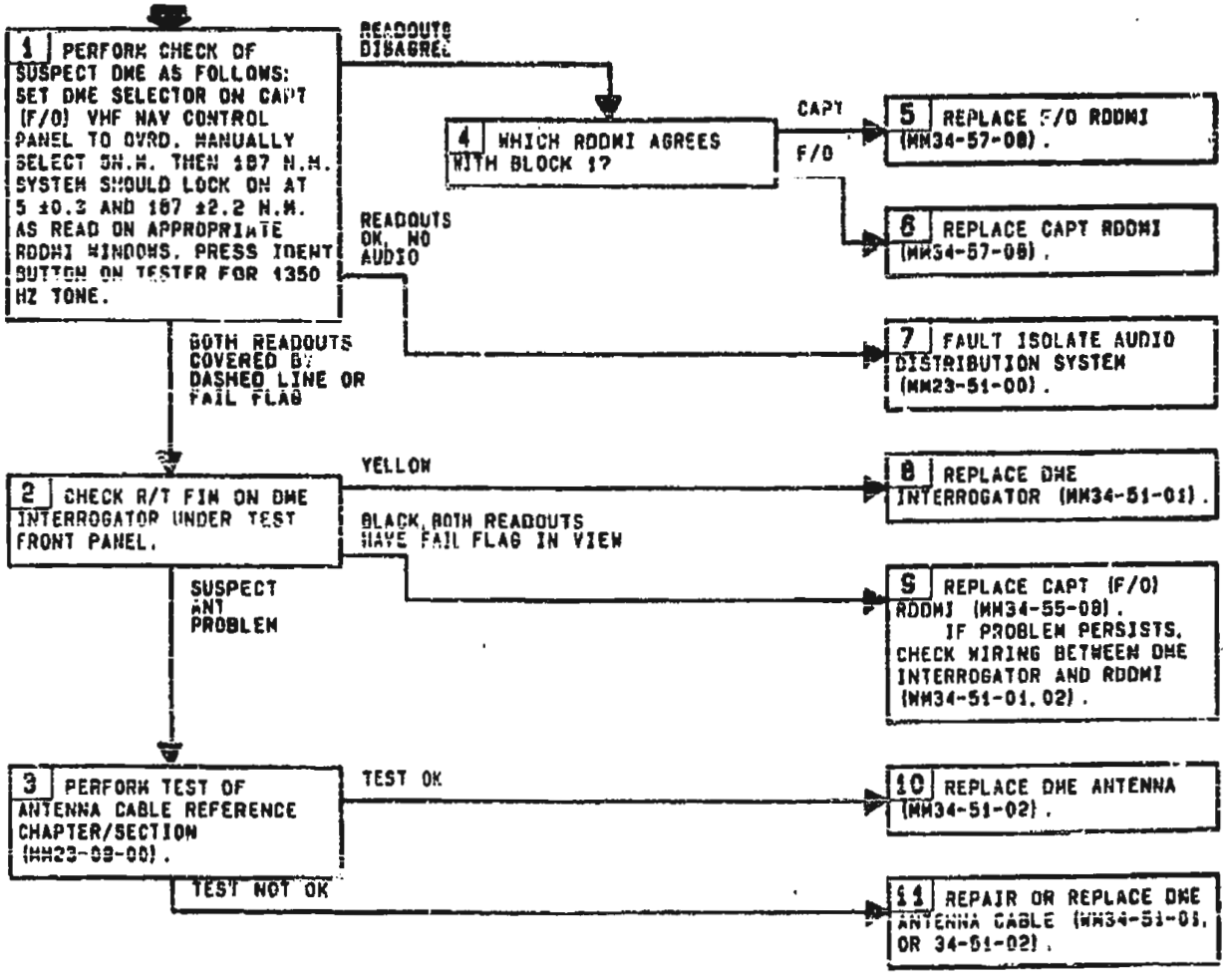
DME System BITE
Figure 103

EFFECTIVITY: ALL

0018

PREREQUISITES
ELECTRICAL POWER (MM24-00-00).
COOLING (MM21-25-00).
CB'S: 1A12, 1D5, 1D23, 1E3, 1E20, 1G1, 1G19, 2A21.
VHF NAV CONTROL PANEL FOR SYS UNDER TEST SET TO 108.00 (DME CHANNEL 17).
CAPT (F/O) AUDIO SELECT PANEL 1-DME (-2) AND SPKR CONTROLS DEPRESSED AND SET TO MID-POSITION.
T24A TEST SET:
SET UP PER INSTRUCTIONS IN COVER.
USE OF TAP-105 ANTENNA MOUNTING PLATE WILL PROBABLY BE NECESSARY.
4920A CABLE ANALYZER (MM23-09-00).

SYSTEM TEST


1 PERFORM CHECK OF SUSPECT DME AS FOLLOWS: SET DME SELECTOR ON CAPT (F/O) VHF NAV CONTROL PANEL TO OVRD. MANUALLY SELECT 5N.M. THEN 187 N.M. SYSTEM SHOULD LOCK ON AT 5 ±0.2 AND 187 ±2.2 N.M. AS READ ON APPROPRIATE RDDMI WINDOWS. PRESS IDENT BUTTON ON TESTER FOR 1350 HZ TONE.
READOUTS DISAGREE
4 WHICH RDDMI AGREES WITH BLOCK 1?
CAPT
F/O
5 REPLACE F/O RDDMI (MM34-57-08).
6 REPLACE CAPT RDDMI (MM34-57-08).
READOUTS OK, NO AUDIO
7 FAULT ISOLATE AUDIO DISTRIBUTION SYSTEM (MM23-51-00).
BOTH READOUTS COVERED BY DASHED LINE OR FAIL FLAG
2 CHECK R/T PIN ON DME INTERROGATOR UNDER TEST FRONT PANEL.
YELLOW
8 REPLACE DME INTERROGATOR (MM34-51-01).
BLACK, BOTH READOUTS HAVE FAIL FLAG IN VIEW
9 REPLACE CAPT (F/O) RDDMI (MM34-55-08). IF PROBLEM PERSISTS, CHECK WIRING BETWEEN DME INTERROGATOR AND RDDMI (MM34-51-01, 02).
SUSPECT ANT PROBLEM
3 PERFORM TEST OF ANTENNA CABLE REFERENCE CHAPTER/SECTION (MM23-09-00).
TEST OK
10 REPLACE DME ANTENNA (MM34-51-02).
TEST NOT OK
11 REPAIR OR REPLACE DME ANTENNA CABLE (MM34-51-01, OR 34-51-02).

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CR
CR

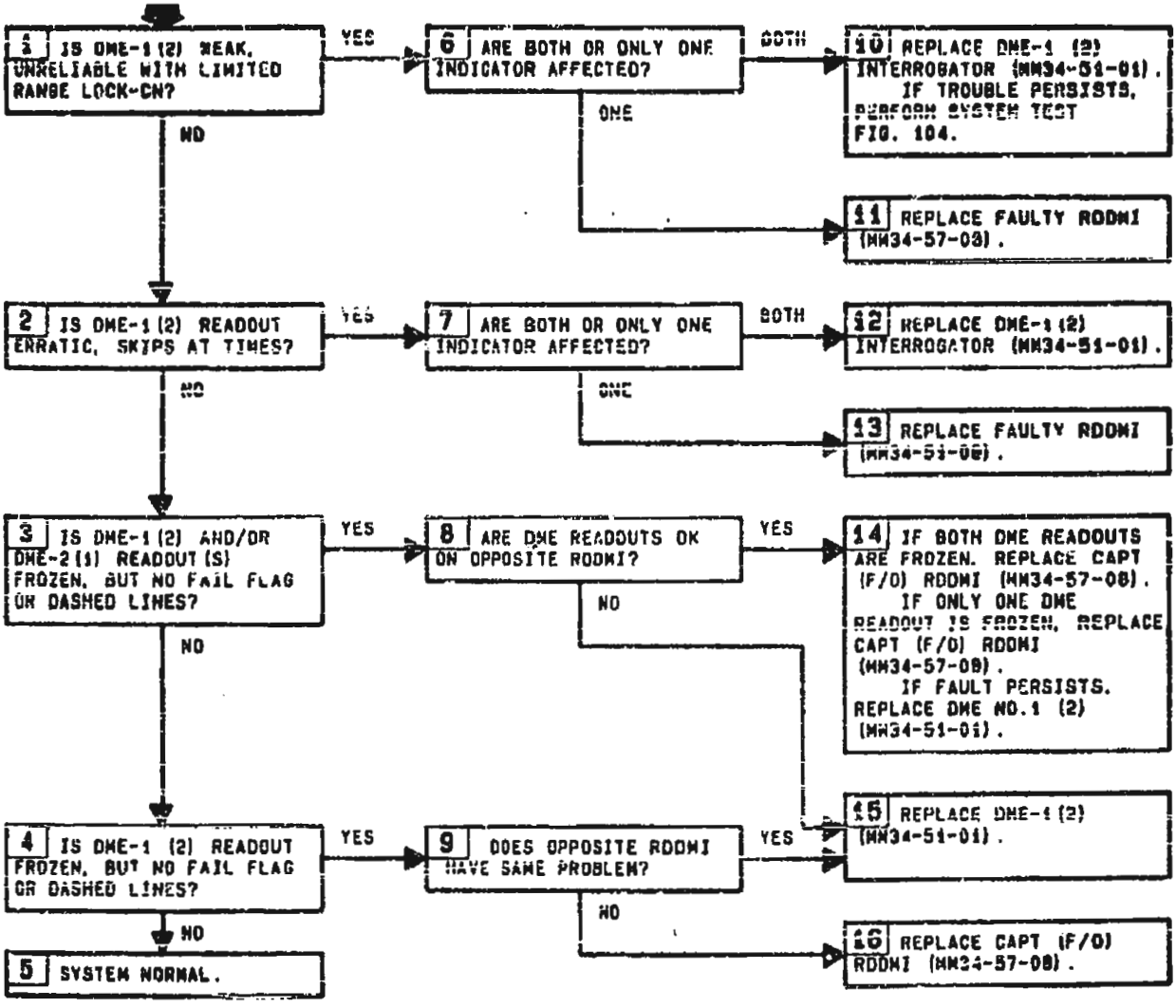
DME System Test
Figure 104

EFFECTIVITY: ALL

0018

PREREQUISITES
ELECTRICAL POWER (MM24-00-00).
COOLING (MM21-28-00).
CB'S: 1A12, 108, 1023, 1E9, 1E20, 161, 1819, 2A21.

DME PROBLEMS


1 IS DME-1 (2) WEAK, UNRELIABLE WITH LIMITED RANGE LOCK-ON?
YES
NO
6 ARE BOTH OR ONLY ONE INDICATOR AFFECTED?
BOTH
ONE
10 REPLACE DME-1 (2) INTERROGATOR (MM34-51-01). IF TROUBLE PERSISTS, PERFORM SYSTEM TEST FIG. 104.
11 REPLACE FAULTY RDDMI (MM34-57-03).
2 IS DME-1 (2) READOUT ERRATIC, SKIPS AT TIMES?
YES
NO
7 ARE BOTH OR ONLY ONE INDICATOR AFFECTED?
BOTH
ONE
12 REPLACE DME-1 (2) INTERROGATOR (MM34-51-01).
13 REPLACE FAULTY RDDMI (MM34-51-06).
3 IS DME-1 (2) AND/OR DME-2 (1) READOUT (S) FROZEN, BUT NO FAIL FLAG OR DASHED LINES?
YES
NO
8 ARE DME READOUTS OK ON OPPOSITE RDDMI?
YES
NO
14 IF BOTH DME READOUTS ARE FROZEN, REPLACE CAPT (F/O) RDDMI (MM34-57-08). IF ONLY ONE DME READOUT IS FROZEN, REPLACE CAPT (F/O) RDDMI (MM34-57-08). IF FAULT PERSISTS, REPLACE DME NO.1 (2) (MM34-51-01).
4 IS DME-1 (2) READOUT FROZEN, BUT NO FAIL FLAG OR DASHED LINES?
YES
NO
9 DOES OPPOSITE RDDMI HAVE SAME PROBLEM?
YES
NO
15 REPLACE DME-1 (2) (MM34-51-01).
16 REPLACE CAPT (F/O) RDDMI (MM34-57-08).
5 SYSTEM NORMAL.

NOTE
TO TEST, PERFORM SYSTEM TEST IN FIG. 104

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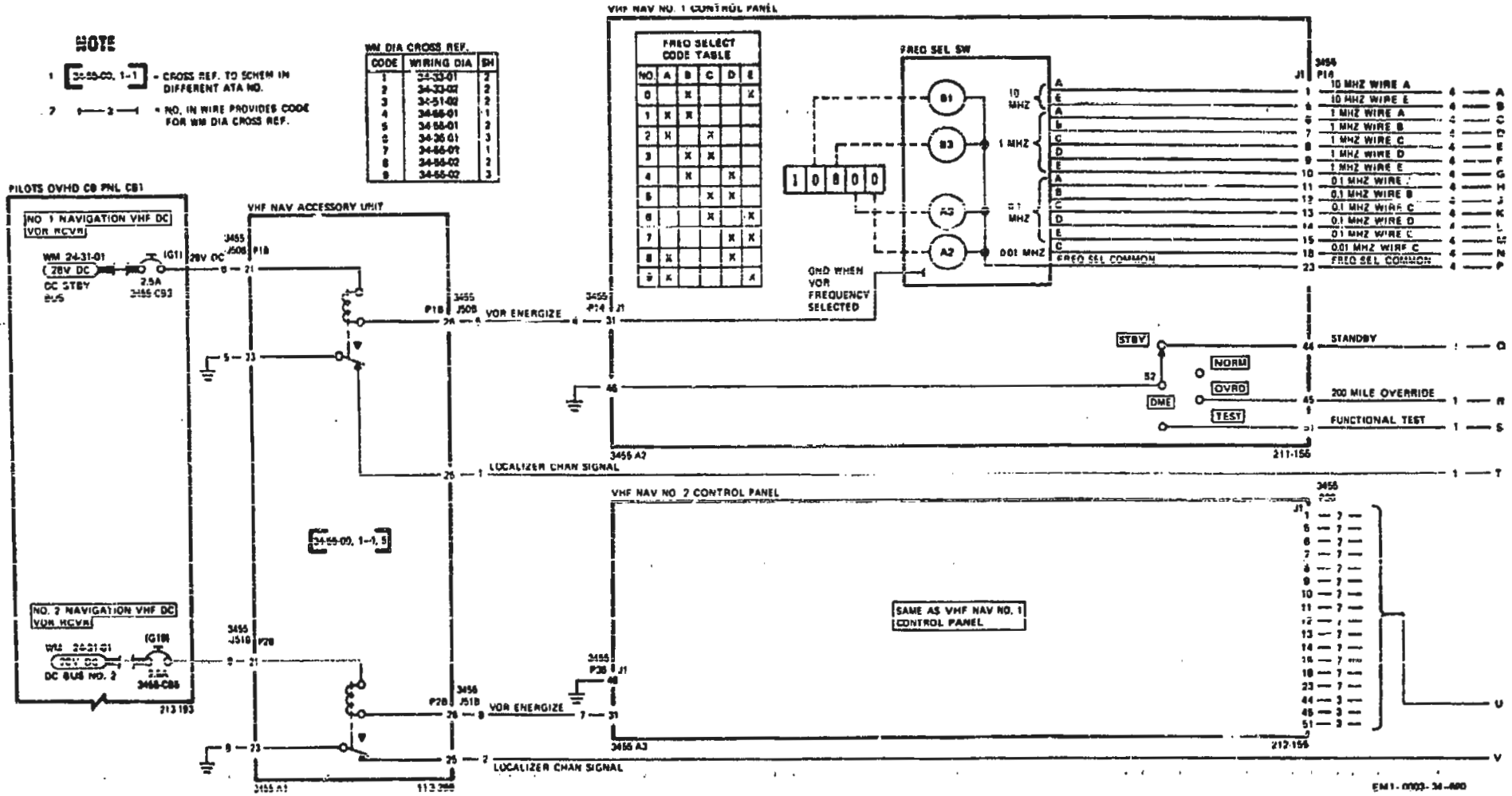
R DME System Problems
R Figure 105

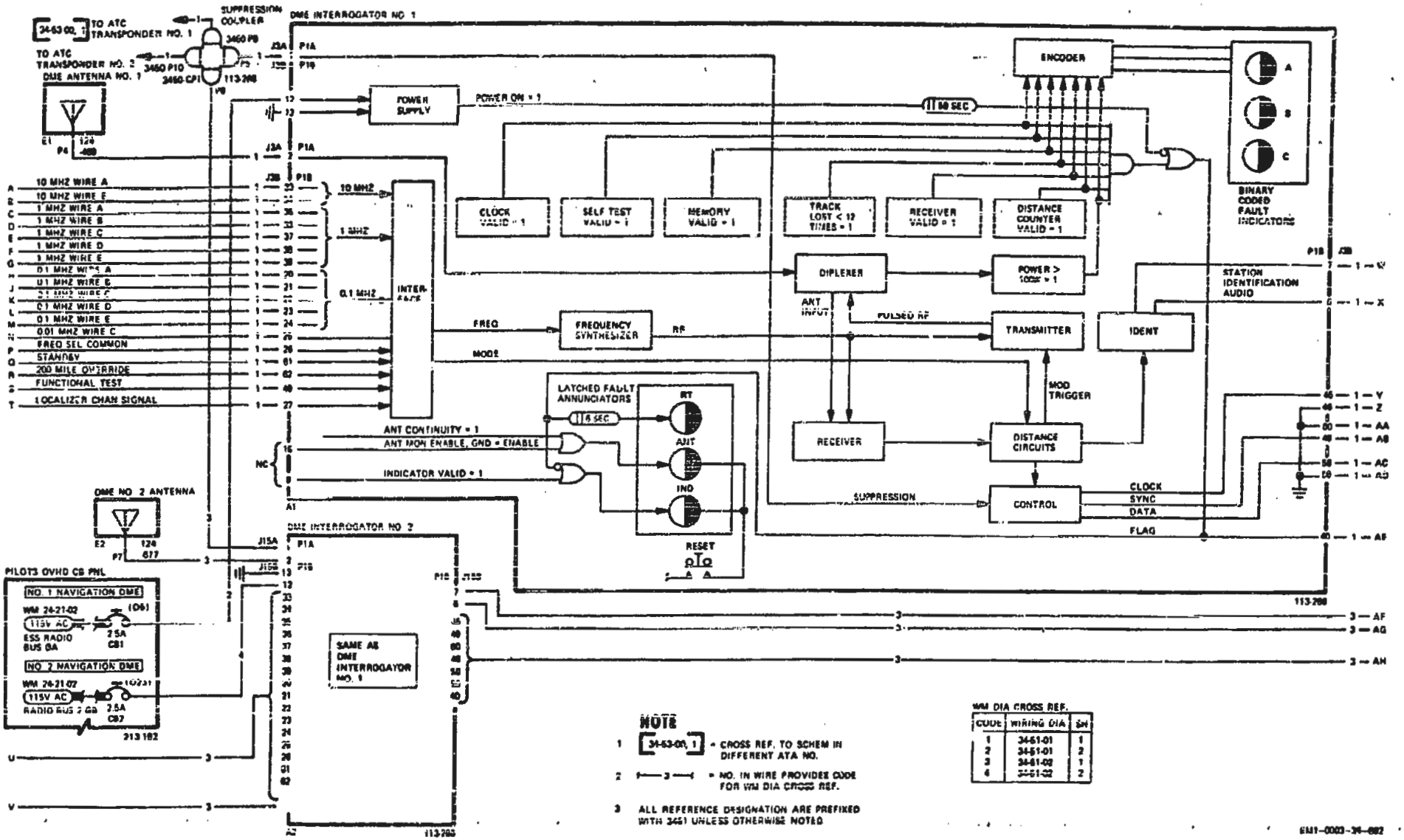
EFFECTIVITY: ALL

001B



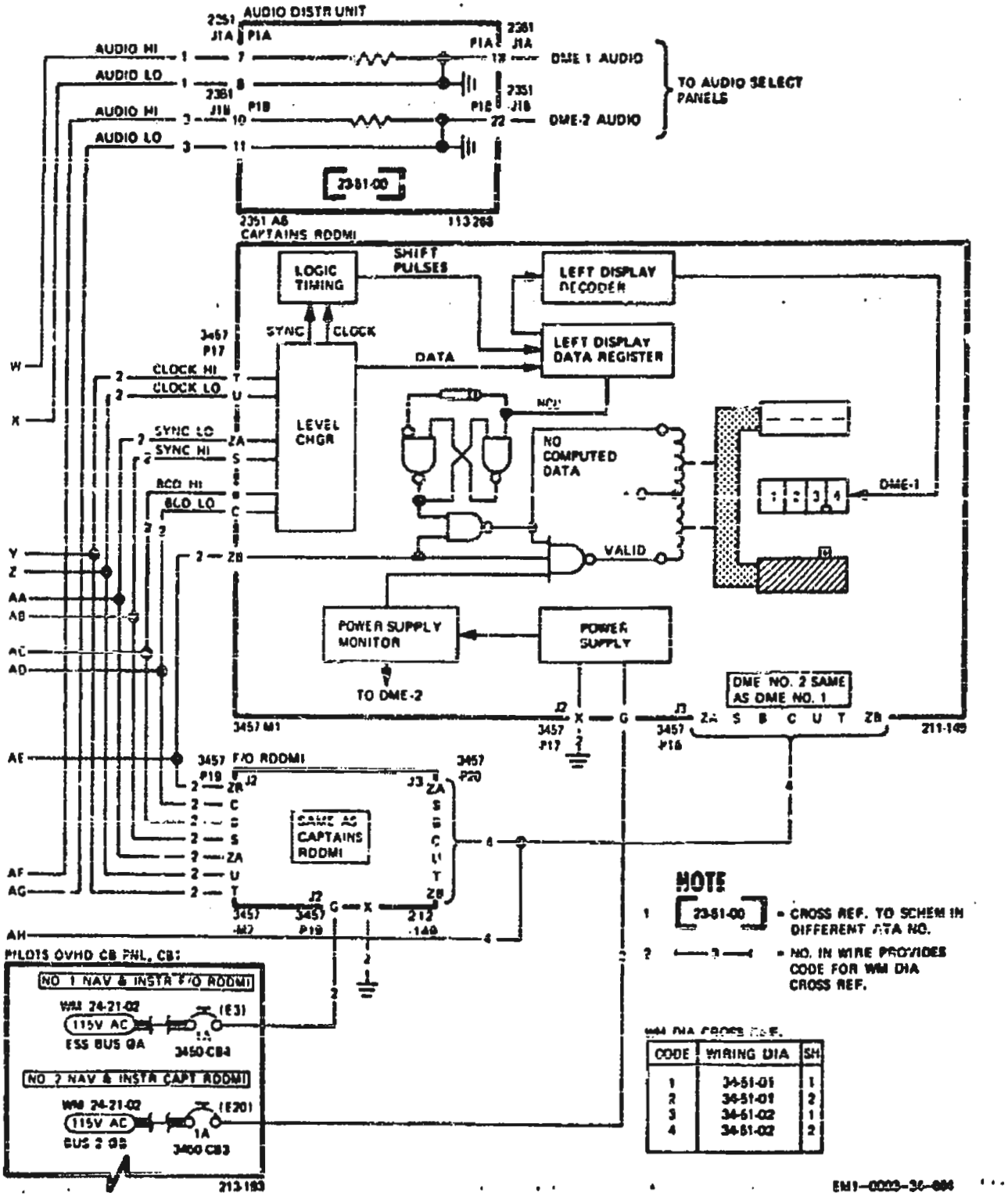
DME System Schematic (VHF NAV Control Panels)
SCHEM 1 (Sheet 1)

R
R
0018 EFFECTIVITY: ALL



DME System Schematic (DMEs)
SCHEM 1 (Sheet 2)

R R 001B EFFECTIVITY: ALL



DME System Schematic (Interface)
SCHEM 1 (Sheet 3)

R
R
001B

EFFECTIVITY: ALL

DME SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

C Tel-Instrument T224A Tester, TWA R&R 90215 or equivalent.

475D-1 DME Ramp Test Set, Collins Part No. 522-2383-00 or equivalent

NOTE: Ramp test set only required to perform functional test.

2. Referenced Procedure

24-00-00 Electrical Power System - Maintenance Practices

3. Adjustment/Test

R NOTE: Satisfactory performance of BITE test (Paragraph 3B)
R ascertains that interrogator and control panel of system
R under test is operable. If antenna and cable are to be
R tested, or if more detailed testing of interrogator and
R control panel are to be performed, procedures in
R functional test (Para. 3C) should be performed.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, zone 210, ensure the following circuit breakers are closed:

NO. 1 NAVIGATION - DME (D5)

NO. 2 NAVIGATION - DME (D23)

NO. 1 NAVIGATION - VHF DC VOR RCVR (G1)

NO. 1 INSTRUMENT - INSTR XFMR NO. 1 (F5)

26V AC NAV EXCITATION - VOR 1 (K21)

NO. 2 NAVIGATION - VHF DC VOR RCVR (G19)

NO. 2 NAVIGATION - INSTR XFMR NO. 3 (D27)

26V AC NAV EXCITATION - VOR 2 (J22)

NO. 1 NAV & INSTR - F/O RDDMI (E3)

NO. 2 NAV & INSTR - CAPT RDDMI (E20)

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify the following circuit breakers are closed:

INSTR COOLING (A21)

F/O INSTR (E5)

PILOTS IND LTS (J2)

CAPT IND LT TEST 2 (H9)

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that CAPT INSTR (J12) circuit breaker is closed.

(4) On MASTER RADIO panel in pilots overhead panel, verify OFF legends on ESSENTIAL and No. 2 switchlights are out. If on, press and release switchlight turning off OFF legend.

(5) Turn on aircraft electrical power (Ref. 24-00-00).

(6) On Flight Engineer/Second Officers ECS MONITOR panel, zone 215, verify AVIONICS AIR - FWD and MID LO FLO lights are out.

(7) Allow 60-second warmup period before proceeding to Step 3B or 3C.

NOTE: The following paragraphs test DME system No. 1 and No. 2. System No. 2 equipment is indicated by parentheses.

B. BITE Test

(1) Perform preparation Step 3A.

(2) Set Captains (First Officers) VHF NAV control panel to 108.00.

A 1350-Hz audio tone is heard along with a display of 000.0(+0.1, -0.0) nautical miles until DME selector switch is released from TEST.

(3) On Captains (First Officers) VHF NAV control panel, momentarily set DME selector switch to TEST.

RESULT:

On Captains and First Officers RDDMI, DME-1 (DME-2) readout is as follows: flag is displayed for one-second, flag retracts and dashes are displayed for one-second, then display changes to 000.0 (+0.2, -0.0)-nautical miles for 3.4 to 12.75-seconds (system memory period).

(4) Set Captains (First Officers) VHF NAV control panel to 108.10, and DME selector switch to NORM.

RESULT:

On Captains and First Officers RDDMI, DME-1 (DME-2) readout window displays dashes (search mode).

(5) If functional test is not to be performed, turn off aircraft electrical power (Ref. 24-00-00).

C. Functional Test

(1) Perform preparation Step 3A.

(2) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

ESSENTIAL COMMUNICATIONS BUS

AUDIO CONTROL - CAPT & F/E (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

(3) On Captains (First Officers) audio select panel located on left (right) side of pilots center console, depress and set 1-DME (DME-2) volume control and SPKR control to midrange.

C NOTE 1: For description and operation of the T-24A
C tester, refer to the Illustration Tool & Equipment
C Manual, chapter/section 34-51-01. NOTE 2: The BATTERY
C CHECK meter in the T-24A will give a constant
C indication of the battery in the unit when the POWER
C switch is on. A fully charged battery will deflect the
C meter to the right hand side of the scale. As the
C battery terminal voltage decreases with use, the needle
C will move toward the red area. When the needle enters
C the red area the battery is discharged and must be
C recharged. It is recommended that, for best battery
C life, the T-24 not be operated until the battery is
C exhausted. It is not necessary to charge the battery

C to operate the unit. Simply plug the line cord into
C any 50-400 Hz 115 volt power source and operate the
C unit in the normal way. The charging circuit will
C provide sufficient power to operate the unit while
C simultaneously charging the battery. NOTE 3: The
C tester may be used in the cockpit. In the event test
C signals are marginal, the antenna mount plate may be
C used to place the antenna outside the aircraft.

C (4) Select 109.0 MHz on the No. 2 VHF NAV control unit and
C 108.0 MHz on No. 1 VHF NAV control unit. Set DME
C switch to OVRD.

C (5) Set the T-24A controls as follows:

C DISTANCE	000.0	N. M.
C EFF	100%	
C FUNCTION	DISTANCE	(out)
C NORMAL	ON	(in)
C ECHO	OFF	(out)
C SQUITTER	2700	(out)
C FREQ	108.00	(out)
C METER	150	(out)

C (6) Press the POWER switch and assertain that the battery
C check meter is indicating in the white portion of the
C scale. If not, charge the battery or operate the unit
C from a 115 volt 50-400 Hz power line.

C (7) Select various distances (0 - 192 N.M.) by moving the
C four DISTANCE lever-wheel switches. Note that the DME
C unlocks after a memory time of about 8 seconds, and
C locks to the new distance, plus or minus 2 N.M.

C (8) Note that the PRF meter is reading the interrogation
C rate of the DME. When lock-on is achieved note again
C the PRF rate, using the 0-30 scale. During search the
C PRF should be approximately 75 Hz. During track
C (lock-on) the PRF should be approximately 18 Hz.

(9) Check for marginal operation of the DME at zero N.M. distance by pressing the -1 N.M. switch and setting the DISTANCE lever-wheel switches to 000.9. This is a net distance of (0.9-1) or -0.1 N.M. After lock-on, the net distance may be reduced further by decreasing the 0.1 N.M. switch in 0.1 N.M. increments until it reads zero. This will be a net distance of -1.0 N. M.

(10) Deleted

(11) Efficiency check shall be made as follows: Set the DISTANCE switches to any convenient point and allow the

DME to lock on at 100% efficiency. Set the efficiency (EFF) switch to 90% and increase the distance by 10 N.M. After memory time, the DME will lock on to the new distance setting. Repeat for 80%, 70% and so on, until the DME no longer can lock on to the reply. DME's must be able to lock to a 70% efficient reply.

(12) The audio portion of the DME shall be checked by pressing the INDENT button. Presence of a 1350 Hz tone should be checked on at least one audio selector box. If INDENT is held down longer than the DME memory time, it will resume the search mode.

(13) Press the POWER switch to turn off the tester. The flag should appear across the No. 1 DME indicators.

R (14) Press the POWER switch to turn on the tester. The flag should disappear from both of the No. 1 DME indicators at lock-on.

(15) Turn OFF the ESSENTIAL radio switch. The flag should appear across the No. 1 DME indicators.

(16) Repeat tests C. (4) through (15) for the No. 2 DME system, using the No. 2 VHF NAV control unit, No. 2 indicators and No. 2 radio switch.

D. Shutdown

(1) On Captains and First Officers audio select panels; depress and release 1-DME (DME-2) and SPKR controls.

(2) Turn off aircraft electrical power (Ref. 24-00-00).

C (3) On ramp test set, set switch to OFF. Remove test set.

DISTANCE MEASURING EQUIPMENT INTERROGATOR REMOVAL AND INSTALLATION

R 1. Referenced Procedure

34-51-00 DME System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION - (D5) DME if removing DME interrogator NO. 1, or NO. 2 NAVIGATION - DME (D23) if removing DME interrogator NO. 2.

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate distance measuring equipment (DME) interrogator on rear rack, shelf 3, (Ref. Fig. 401).

(3) Loosen and disengage knurled knobs securing DME interrogator to mount.

(4) Pull DME interrogator forward until rear connector is disconnected from mount connector.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

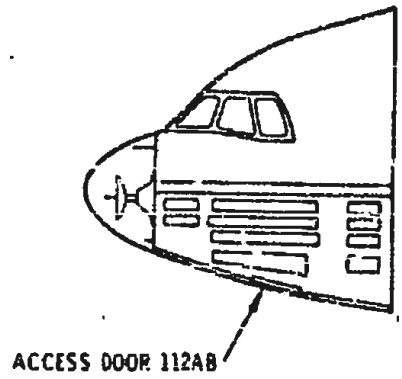
(2) Position DME interrogator on mount and slide into place, aligning rear connector and mount connector.

(3) Place mount clamps over DME interrogator hooks. Tighten knurled knobs securing DME interrogator to mount.

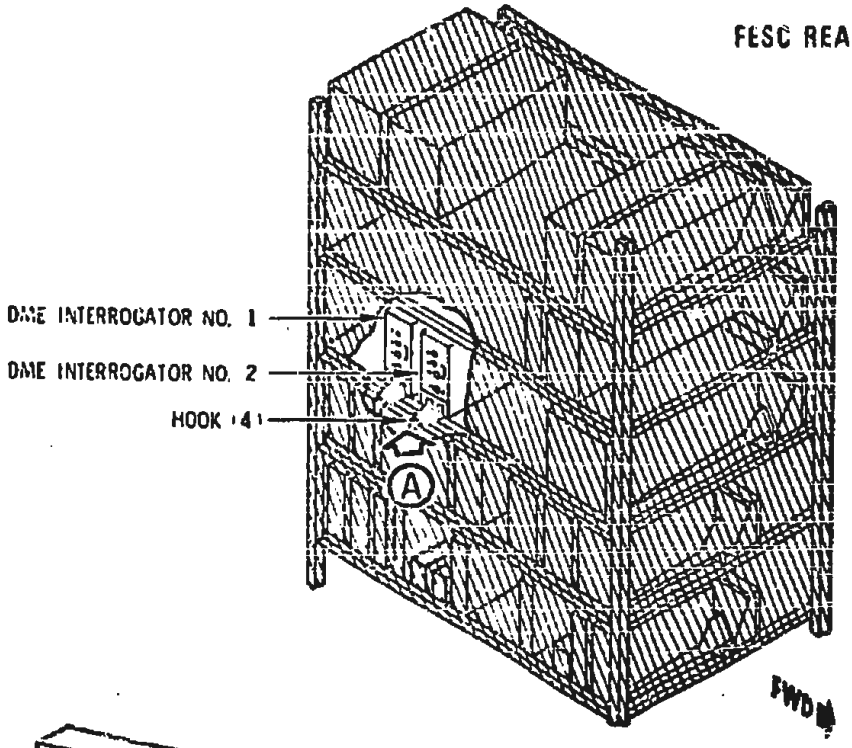
(4) Close and secure access door.

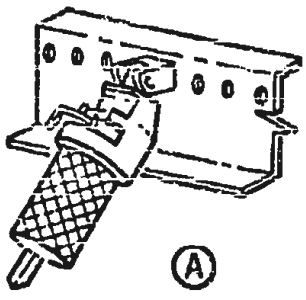
(5) Remove tag and close circuit breaker opened in Step A(1).

(6) Perform DME System adjustment and test procedure.



FESC REAR RACK, SHELF NO. 1





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Distance Measuring Equipment Interrogator
Removal and Installation
Figure 401

DISTANCE MEASURING EQUIPMENT ANTENNA - REMOVAL AND INSTALLATION

1. Referenced Procedure

34-51-00 DME System - Adjustment and Test

51-25-00 Environmental Sealing

2. Equipment and Materials

Soft clean cloths

Plastic scraper

Gloves, disposable, MIL-G-36281, or equivalent

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279), Mfg P/N PR1436G-B2, TWA Stk Nbr 50-1188)

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION - DME (D5) if removing DME antenna NO. 1, or NO. 2 NAVIGATION - DME (D23) if removing DME antenna No. 2.

(2) Locate distance measuring equipment (DME) antenna on bottom centerline of aircraft; system No. 1 antenna at
R FS 485, system No. 2 antenna at FS 665 (Ref. Fig. 401).

(3) Remove bolts securing antenna to bottom of fuselage.

(4) Lower antenna sufficiently to remove antenna connector. Remove antenna and packing.

R WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

KEEP MEK AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

(5) Use plastic scraper to remove sealant from fuselage structure. Use soft clean cloth moistened with methyl-ethyl-keytone solvent and wipe fuselage structure clean.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

R WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

CR (2) Use clean soft rag moistened with trichloroethane CR solvent to clean faying surfaces of fuselage skin and CR antenna mounting plate. Before cleaning solvent dries, CR wipe dry with clean rag.

CR (3) Spray fuselage and antenna mating surfaces with LPS-3 CR corrosion inhibiter. Replace packing around connector.

CR (4) Start coaxial connector threads, spray remaining CR threads with LPS-3 then secure connector.

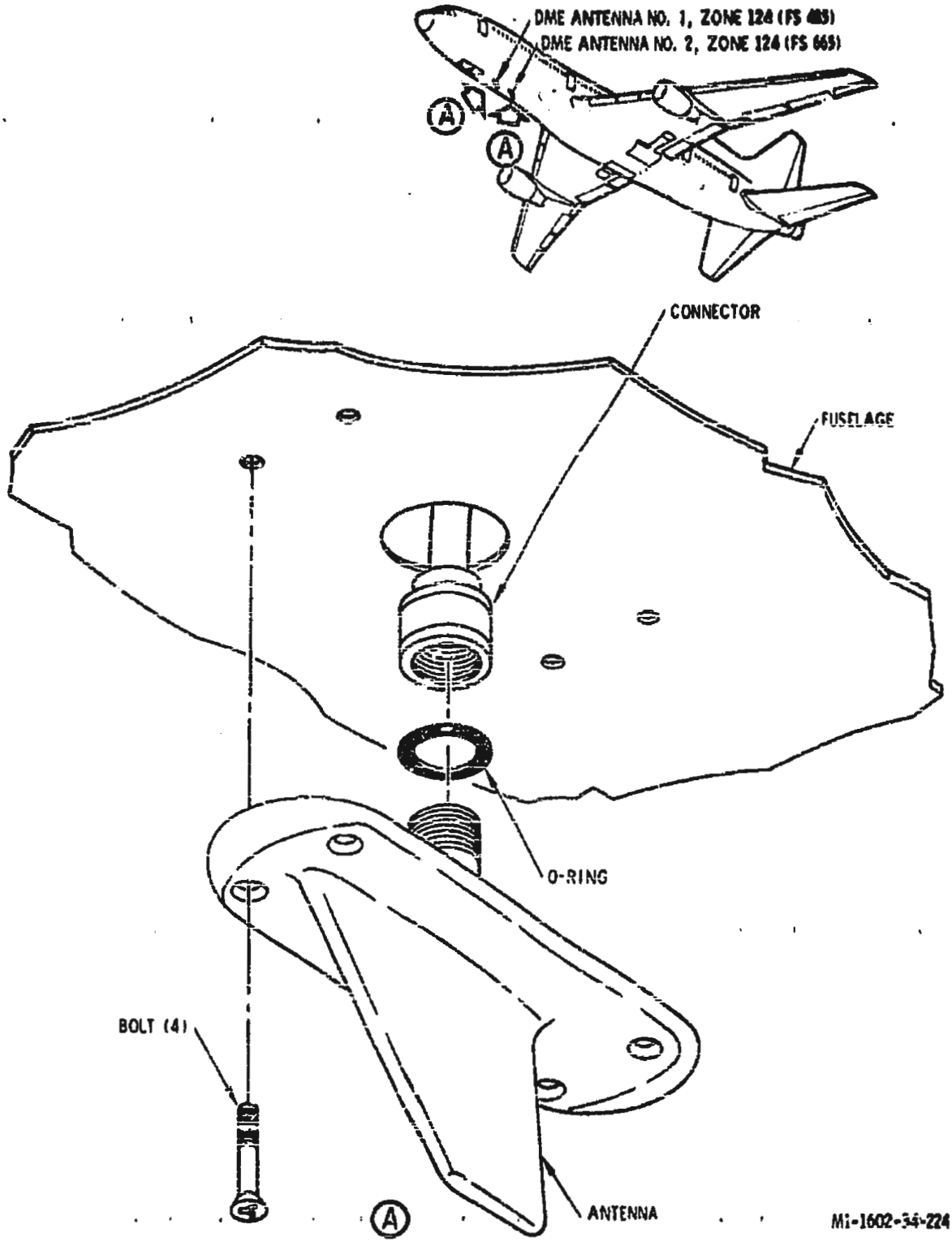
CR (5) Replace packing and position antenna, aligning mounting CR holes on antenna and fuselage.

CR (6) Install and tighten bolts securing antenna to fuselage.

CR WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. C PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE C IRRITATION.

CR NOTE: Before applying aerodynamic sealant, remove the CR LPS-3 corrosion inhibiter from the area to be CR sealed as it may prevent adherence of the CR sealant.

CR (7) Apply a continuous sealant fillet between antenna CR mounting plate and fuselage using Environmental CR Sealant, LAC Spec C-40-1279 or equivalent.



R Distance Measuring Equipment Antenna
R Removal and Installation
R Figure 401

CR (8) Remove tags and close circuit breaker opened in Step
CR 2A(1).

CR (9) Perform DME system adjustment and test procedure (Ref.
CR 34-51-00)

AIR TRAFFIC CONTROL TRANSPONDER SYSTEM - DESCRIPTION AND OPERATION

1. General

There are two independent air traffic control (ATC) transponder systems installed in the aircraft (Ref. Fig. 1). Each system consists of a 621A-6 ATC transponder, an antenna and a common control panel; which controls both ATC systems. The number one
R ATC transponder primary power is supplied from ac standby bus
R (Phase A), through NO. 1 NAVIGATION ATC (G3) circuit breaker;
R number two ATC transponder primary power is supplied from No. 2
R ac electrical bus (Phase B), through NO. 2 NAVIGATION ATC (G21)
R circuit breaker.

R When the ATC transponder selected on the control panel is interrogated by a ground station, the system automatically transmits a pulse-coded reply signal to the ground station. The reply signal is used by the ATC controller at the ground station to locate and identify the aircraft. The reply signal provides the ATC controller at the ground station with aircraft range, bearing, altitude, and identification information. The information is displayed on the ground station radar indicator presentation. Since the distance measuring equipment (Ref.
R 34-51-00) operates in the same frequency band as the ATC transponders; simultaneous operation of a DME interrogator and an ATC transponder is prevented by suppression pulse output/input circuits.

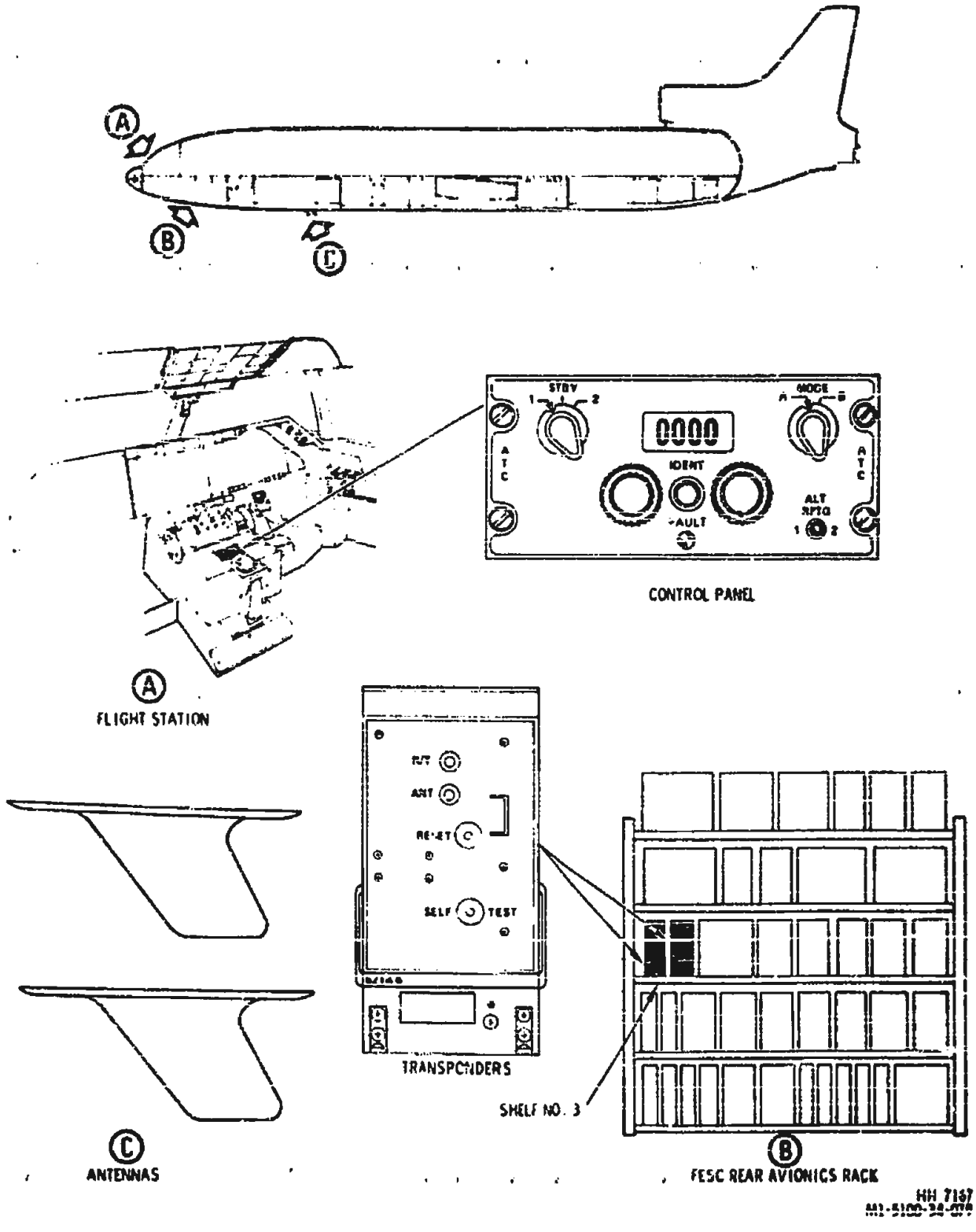
The ATC transponders are located in the forward electronics service center rear rack, zone 112. The control panel is located in the flight station, and is mounted on the center console below the weather radar control panel (Ref. 34-44-00).
R The antennas are mounted at the bottom centerline of aircraft,
R No. 1 at FS 559 and No. 2 at FS 599. The No. 1 NAVIGATION ATC and No. 2 NAVIGATION ATC circuit breakers are located on the pilots overhead circuit breaker panel CB1, zone 210.

2. Operation

R The ATC transponder control panel provides transponder selection, code selection, air data computer (ADC) selection, mode selection, identification pulse keying, and fault indication information for the ATC system.

A. 1-STBY-2

The 1-STBY-2 selector allows either ATC transponder No. 1 or
R No. 2 to be selected. When switch is in STBY; power is
R applied to both ATC transponders, but the transmitters are



R
R

ATC Transponder System
Figure 1

EFFECTIVITY: ALL

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R inhibited. When switch is in No. 1 or No. 2 position, the
R applicable ATC transponder is enabled to reply to
R interrogations. The other ATC transponder is in standby.

B. A-MODE-B

The A-MODE-B switch is used to select the ATC transponder mode of operation. The selected ATC transponder responds to a three-pulse interrogation signal. The three-pulse interrogation signal consists of pulses designated P1, P2, and P3. When the A-MODE-B switch is set to A, the selected ATC transponder only responds to an interrogation signal
R with an 8-microsecond spacing between P1 and P3 pulses. When set to B, the selected ATC transponder only responds to an interrogation signal with a 17-microsecond spacing between P1 and P3 pulses.

C. ALT RPTG/1-2-OFF

Selects either ADC number one, or ADC number two (Ref. 34-14-00) as the ATC transponder input used for altitude reporting (mode C). When set to OFF; the ATC altitude reporting function is inoperative. When the ALT RPTG switch is set to 1, or 2, the selected ATC transponder is enabled to respond to a mode C interrogation signal as well as the selected mode interrogation signal. The mode C
R interrogation signal has a 21-microsecond spacing between P1
R and P3 pulses.

R D. IDENT

R When pressed, enables the selected ATC transponder to
R transmit an 0.5-microsecond identification pulse
R 4.35-microseconds after the normal coded reply signal. When the identification pulse is transmitted, the normal ATC transponder reply pulse displayed on the ground station ATC controller radar scope blooms, and identifies the aircraft. The identification pulse is only transmitted when requested by the ground station ATC controller.

E. FAULT

The FAULT lamp is controlled by the fault lamp driver circuit located on monitor circuit board (A8) in the selected ATC transponder. If a fault occurs in the selected ATC transponder, a voltage output from the monitor circuit board energizes either the R/T or ANT fault indicators on the selected ATC transponder front panel and the FAULT indicator on the control panel.

F. Code Selectors

The code selectors are used to select the four digits of the transmitted reply signal. The code selector range is 0000 to 7777. The coded reply signal consists of 2 to 16 coded pulses. The number of pulses transmitted in the reply signal is controlled by the code set on the code selectors.

Primary surveillance radar (PSR) and secondary surveillance radar (SSR) are the two types of ground based radar equipment used with the ATC transponder system. The PSR is used to locate and track all aircraft within the control area. The SSR is scan-synchronized with the PSR, and is used to identify transponder equipped aircraft by transmitting interrogation signals and receiving coded replies. The PSR and SSR information is displayed on the ATC controller radar indicator, enabling the ground controller to identify transponder equipped aircraft in addition to displaying range and direction of all aircraft within assigned control area (Ref. Fig. 2).

The airborne ATC transponder is interrogated by the three-pulse side lobe suppression (SLS) method. A directional antenna is used to transmit a pair of pulses, designated P1 and P3. Two microseconds after the P1 pulse is transmitted from the directional antenna the second pulse, designated P2, is transmitted from an omnidirectional antenna. The P2 pulse is used as the reference pulse for the SLS interrogation system. The three pulses are each 0.8-microsecond wide.

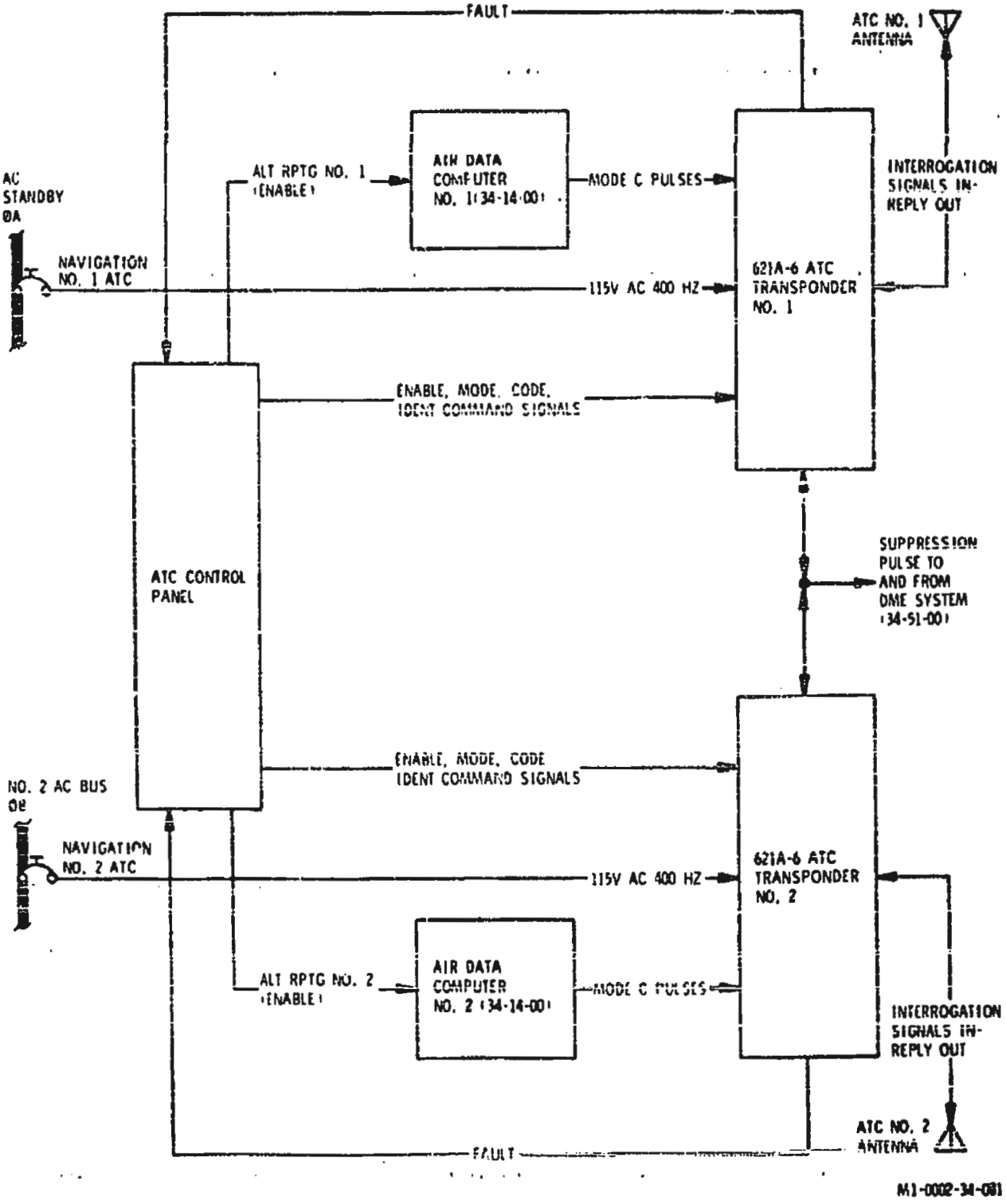
NOTE: As an airborne ATC transponder equipped aircraft proceeds closer to the ground-based surveillance radar, the possibility of the airborne ATC transponder being triggered by the side lobe of the surveillance radar rather than by the main lobe increases. The amplitude of the P2 interrogation pulse is adjusted so that its amplitude is the same as that of the maximum side lobe pulse generated by the surveillance

The received interrogation signal is analyzed by the airborne ATC transponder to determine the validity of the signal and the mode of operation of the interrogation signal. The interrogation signal must be from the main lobe of the SSR and must also be in the mode corresponding to that selected on the ATC control panel for the signal to be considered valid. When a valid interrogation signal is received, a reply signal is transmitted by the ATC transponder.

3. 621A-6 ATC Transponder

A. Description

The 621A-6 ATC transponder consists of a receiver section, a decode/encode section, and a transmitter section. The


FAULT
ATC NO. 1 ANTENNA
AC STANDBY 0A
ALT RPTG NO. 1 (ENABLE)
AIR DATA COMPUTER NO. 1 (34-14-00)
MODE C PULSES
INTERROGATION SIGNALS IN-REPLY OUT
NAVIGATION NO. 1 ATC
115V AC 400 HZ
621A-6 ATC TRANSPONDER NO. 1
ENABLE, MODE, CODE, IDENT COMMAND SIGNALS
ATC CONTROL PANEL
SUPPRESSION PULSE TO AND FROM DME SYSTEM (34-51-00)
NO. 2 AC BUS 0B
NAVIGATION NO. 2 ATC
ENABLE, MODE, CODE IDENT COMMAND SIGNALS
115V AC 400 HZ
621A-6 ATC TRANSPONDER NO. 2
ALT RPTG NO. 2 (ENABLE)
AIR DATA COMPUTER NO. 2 (34-14-00)
MODE C PULSES
INTERROGATION SIGNALS IN-REPLY OUT
ATC NO. 2 ANTENNA
FAULT
M1-0002-34-081

R ATC Transponder System Block Diagram
R Figure 2

EFFECTIVITY: ALL

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transponder case is provided with bottom-hinged side covers for access to the modules. The IF amplifier, the shift register, and monitor circuits are mounted on the inside of the side covers. All other subassemblies are mounted on the chassis.

The transponder front panel is provided with the following maintenance aids:

(1) Two fault annunciators (R/T and ANT) indicate the status of the respective components. The annunciators are normally black, but change to yellow when a fault occurs.

(2) A RESET switch is provided to reset the ANT fault annunciator.

NOTE: The R/T fault indicator must be reset by grounding jack A3-50 in the transponder.

(3) A SELF TEST switch with an integral reply light is provided to initiate the self-test mode of operation and to indicate that the transponder has successfully replied to an interrogation.

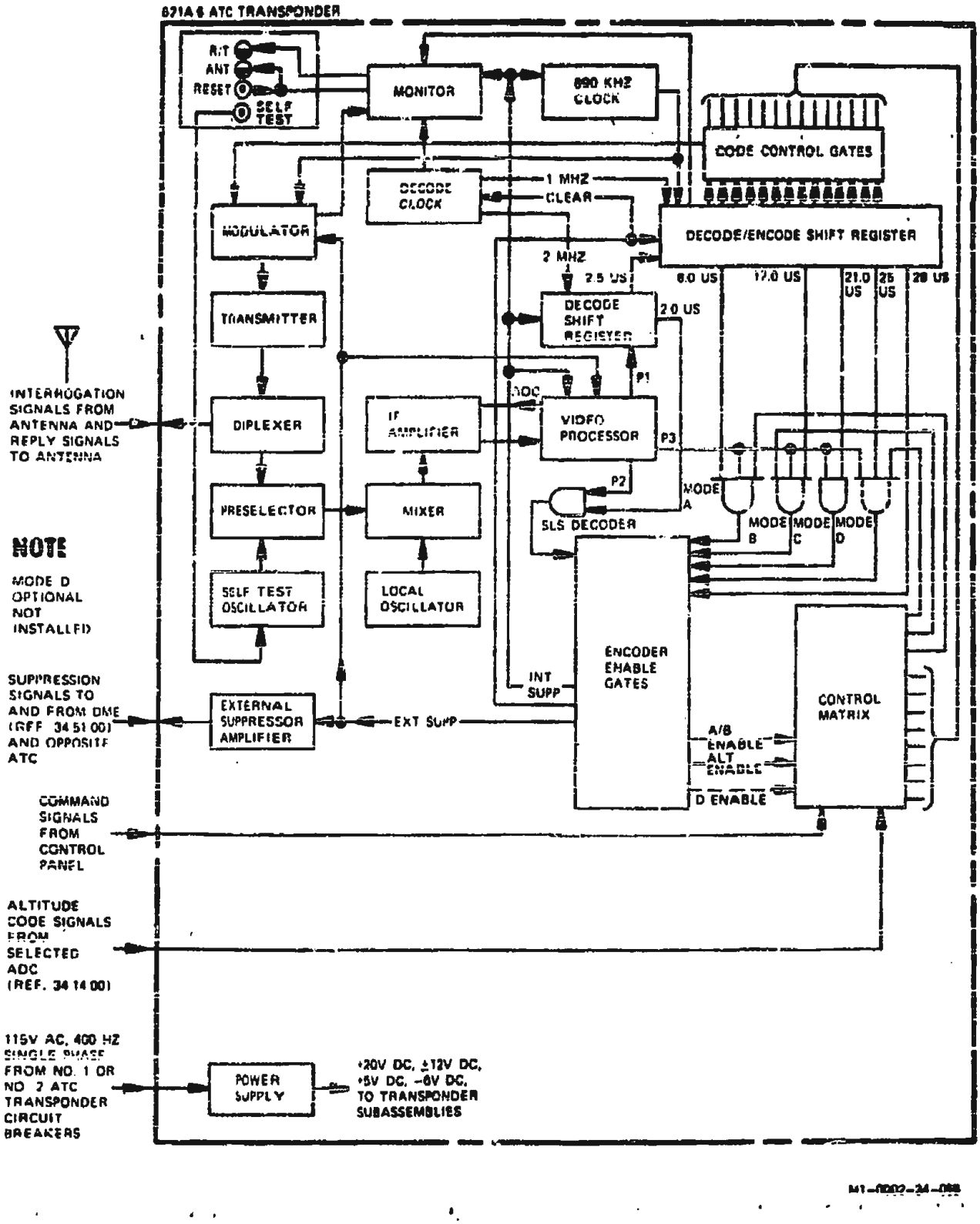
(4) An ATE (automatic test equipment) connector is provided on the rear of the case, which may be used for fault isolation.

B. Operation

When a mode A, B and/or C interrogation signal (1030-MHz) is received by the antennas, the signal is routed to the transponder duplexer input through coaxial cable. The duplexer applies the received signal to the preselector, and the transmitted signal to the antenna, which provides receiver-transmitter isolation (Ref. Fig. 3).

The received interrogation signal is applied to the preselector from the duplexer. The preselector consists of three tuned cavities providing image and spurious response rejection. The preselector output signal is applied to the mixer where it is mixed with the local oscillator signal and converted to the 60-MHz IF signal.

The 60-MHz IF signal is amplified, detected, amplified again, and then applied to the video processor. The video processor analyzes the detected interrogation signal to determine the validity of the interrogation signal. When a valid interrogation signal is received (amplitude difference between P1 and P2 pulses greater than -6 db) the P1 and P3 pulse outputs of the video processor are applied to the mode



M1-0002-24-088

R R 621A-6 ATC Transponder Block Diagram
Figure 3

EFFECTIVITY: ALL

001B

R decoders. When an invalid interrogation signal is received
R (amplitude difference between P1 and P2 pulses less than -6
R db), the modulator is inhibited, which prevents the
R transmission of a reply signal.

R To prevent interference, DME and ATC equipment generates a suppression pulse when either is in transmit mode. When the suppression pulse from the DME is received by the selected transponder, the video processor output is inhibited, which prevents the transponder from going into the transmit mode and replying to a side lobe interrogation signal.

When a valid mode interrogation signal is received (mode A, for example), the P1 pulse from the video processor is applied to the decode/encode shift register, and the P3 pulse from the video processor is applied to the mode decoder gate (the P3 pulse is applied 2-microseconds after the P1 pulse output in mode A). The P1 pulse output from the decode/encode shift register and the P3 pulse output from the mode detector gate are applied simultaneously to the mode A gate, enabling the gate.

NOTE: This only applies during a valid mode A interrogation, as the P1 and P3 pulse spacing is 8-microseconds only in mode A.

If the received interrogation signal is a signal other than a valid mode A interrogation, the P1 and P3 pulses enable one of the other mode gates, depending on the P1 and P3 pulse spacing (mode B-17 microseconds, mode C-21 microseconds, and mode D when activated 25-microseconds).

Mode A or B is selected on the control panel. Mode D (presently not activated) is controlled by external selection (data link equipment provision). Mode C, altitude reporting, is automatic as long as the ALT RPTG switch on the control panel is in either the 1 or 2 position. This mode is deactivated when the ALT RPTG switch is set to OFF.

When an SLS interrogation signal is received and decoded, the mode memory circuit is enabled and provides two outputs. One output is an internal suppression signal applied to the video processor, the decode shift register, the encoder clock, and the monitor circuit disabling the decoder circuits within the transponder when an SLS (invalid) interrogation signal is received. The second output from the mode memory circuit resets the decode/encode circuit and applies a stop pulse to the mode memory circuit. The stop pulse resets the mode memory circuit, which returns the transponder to the decode mode of operation and inhibits all the encode mode circuits.

When a valid mode interrogation signal is received (mode A, for example) and decoded, a mode A start pulse is applied to the mode memory circuit, which causes the mode memory circuit to generate four outputs. Two outputs (internal suppression and clear or stop) perform the same function as when an SLS interrogation pulse is received. The third output (external suppression) is applied to the DME equipment and to the transponder modulator. The fourth output is applied to the control gate enabling the modulator, allowing a reply to be transmitted. The setting of the control panel code select switches controls whether the reply gates pass or reject the decode/encode shift circuit output signal (decoded interrogation pulse) and controls the reply gate enabling the reply signal to be transmitted.

NOTE: The mode C, altitude reporting code is controlled by the air data computer (Ref. 34-14-00).

When a valid mode C interrogation signal is received (altitude reporting) and decoded, another mode memory circuit output (altitude enable) permits the altitude code signals from the air data computer to be applied to the transponder modulator through the control matrix.

When the reply data is applied to the reply gates, a pulse is applied to the modulator and monitor circuit for each reply gate enabled by the control matrix. The modulator uses these pulses to drive the transmitter. Simultaneously, an overload control circuit within the monitor counts the number of pulses applied to the modulator. If the number of reply gate pulses or external suppression pulses exceeds a preset level, an automatic overload control (AOC) signal is generated, which reduces the IF amplifier sensitivity. This reduces the transponder reply rate and sensitivity and inhibits weaker interrogation signals from initiating a reply.

The transponder front panel is provided with R/T and ANT fault annunciators and a SELF TEST pushbutton switch with a REPLY light. When either the R/T or the ANT fault annunciators on the front panel are activated, the FAULT light on the control panel comes on. The operation of these indicators is controlled by the monitor circuit. When four consecutive replies are received, the monitor circuit turns on the reply light. If a fault occurs, a voltage output from the monitor turns on the FAULT light on the control panel and activates one of the two fault annunciators on the front panel. The ANT fault annunciator is reset manually by pressing the RESET button on the front panel and the R/T fault annunciator is reset manually by grounding jack A3-50 in the transponder.

The transponder self test is initiated by pressing the SELF TEST pushbutton switch on the front panel. When the SELF TEST switch is actuated, a self-test signal is generated by the self-test oscillator, and applied to the preselector. The signal is then processed as a valid interrogation signal. If no fault exists, a reply signal is generated, and the reply light comes on to indicate acceptable transponder operation.

4. ATC Control Panel

A. Description and Operation

The ATC transponder control panel contains six, 5V ac internally-mounted panel lights and four 5V ac internally-mounted dial lights for nighttime illumination.

The following ATC transponder system operating controls and indicators are provided on the control panel:

A three-position wafer switch, placarded 1-STBY-2, controlling transponder selection

A two-position wafer switch, placarded A-MODE-B, controlling the mode of operation of the selected transponder

A pushbutton switch, placarded IDENT, controlling the initiation of an identification pulse transmission

A light, placarded FAULT, is turned on by the selected transponder when a fault occurs in the selected ATC system

A three-position toggle switch, placarded ALT RPTG/1-2-OFF, controlling ADC selection and mode C operation

A four-deck wafer switch with a separate control for each deck, provided with a digital readout window, controlling the code set into the selected transponder. Clockwise rotation of the four code selectors produces counter-clockwise rotation of the four switch decks. The range of the digital code readout window is from 0000 to 7777.

5. ATC transponder Antenna

A. Description and Operation

The L-band antenna is a blade-type antenna. Electrical connection to the antenna is made using a type-N coaxial connector located at bottom of antenna base. The coaxial connection is weather-proofed by an O-ring located in a groove surrounding the coaxial connector.

The antenna operates in the frequency range of 960-MHz to 1200-MHz. The antenna has a VSWR (voltage standing wave ratio) of 1.7 to 1 over the entire operating range.

NOTE: When operating in the frequency range of 1000-MHz to 1100-MHz, the antenna has a VSWR of less than 1.42 to 1.

The antenna has a 50-ohm input impedance. It is vertically polarized and radiates and receives in an omnidirectional pattern.

R AIR TRAFFIC CONTROL TRANSPONDER SYSTEM - FAULT ISOLATION

1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

R If flight crew reports a trouble using a fault code, the code can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

R Refer to Maintenance Manual Introduction for more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

R To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Supplemental Fault Isolation Data

A knowledge of the digital encoding system used for Altitude Reporting on the ATC Transponder is necessary for troubleshooting the system.

For example, at 35,000 feet the code transmitted is 5124 or A5-B1-C2-D4; A5 = A1 + A4, B1 = B1, C2 = C2 and D4 = D4, all grounded in the alticoder. Now, let's say B2, for example, had an unwanted ground on it. Although the aircraft altitude would be 35,000 feet, the ATC center's scope would see 36,500 feet displayed. If the crew were to write this up, examination of the table of codes would reveal code 5324 was being transmitted. Which wire is grounded when it should not be? B2 has an unwanted ground -- B1 + B2 = B3. Since B2 has a permanent ground on it, altitude blocks -200 to 1800 feet, 3800 to 5800

feet, 7800 to 9800 feet, etc. would show a correct altitude readout whereas every segment in between these blocks would show an erroneous readout using either ALT source or either transponder.

Another example: If D4 had an unwanted ground, all altitudes below 30,800 feet would show erroneous readouts using either ALT source or either transponder whereas an open D4 wire would show erroneous readouts above 30,700 feet on only one ALT source or on only one transponder, depending upon where it has opened.

A knowledge of code derivation and examination of the reply - code table can pinpoint the problem. Ohmmeter checks can then be made to isolate the problem area and correct the wiring problem (assuming the altitude source or transponder are not faulty). Alticoder input to the transponders is as follows:

Digit:	621A-6 Transponder Connector Pins:
A1	31
2	32
4	33
B1	34
2	34
4	36
C1	37
2	38
4	39
D4	41

As will be noted, altitude reporting tests performed at station elevation are not adequate to detect many defects. Therefore, new Pitot/Static tests must be followed to verify that
CR corrective action is effective.

Refer to Tables 101 through 105 for Mode C altitude versus reply codes.

3. Equipment and Materials

476X-3 ATC Ramp Test Set, Collins P/N 522-4475-001, or equivalent

NOTE: Test set required only if procedures in Figure 104, 105 and 106 are to be performed.

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
-1,000	0020	3,000	4120	7,000	6020
-900	0030	3,100	4130	7,100	6030
-800	0010	3,200	4110	7,200	6010
-700	0410	3,300	4610	7,300	6410
-600	0430	3,400	4630	7,400	6430
-500	0420	3,500	4620	7,500	6420
-400	0460	3,600	4660	7,600	6460
-300	0440	3,700	4640	7,700	6440
-200	0640	3,800	4740	7,800	6640
-100	0660	3,900	4760	7,900	6660
000	0620	4,000	4720	8,000	6620
100	0630	4,100	4730	8,100	6630
200	0610	4,200	4710	8,200	6610
300	0210	4,300	4310	8,300	6210
400	0230	4,400	4330	8,400	6230
500	0220	4,500	4320	8,500	6220
600	0260	4,600	4360	8,600	6260
700	0240	4,700	4340	8,700	6240
800	0340	4,800	4240	8,800	6340
900	0360	4,900	4260	8,900	6360
1,000	0320	5,000	4220	9,000	6320
1,100	0330	5,100	4230	9,100	6330
1,200	0310	5,200	4210	9,200	6310
1,300	0710	5,300	4610	9,300	6710
1,400	0730	5,400	4630	9,400	6730
1,500	0720	5,500	4620	9,500	6720
1,600	0760	5,600	4660	9,600	6760
1,700	0740	5,700	4640	9,700	6740
1,800	0540	5,800	4440	9,800	6540
1,900	0560	5,900	4460	9,900	6560
2,000	0520	6,000	4420	10,000	6520
2,100	0530	6,100	4430	10,100	6530
2,200	0510	6,200	4410	10,200	6510
2,300	0110	6,300	4010	10,300	6110
2,400	0130	6,400	4030	10,400	6130
2,500	0120	6,500	4020	10,500	6120
2,600	0160	6,600	4060	10,600	6160
2,700	0140	6,700	4040	10,700	6140
2,800	4140	6,800	6040	10,800	2140
2,900	4160	6,900	6060	10,900	2160

Code Derivation: None Grounded = 0
A1 = 1 A1 + A2 = 3 A1 + A4 = 5
A2 = 2 A4 = 4 A2 + A4 = 6
A1 + A2 + A4 = 7
--- Etc for B, C & D

MI-0000-34-2172

Mode C Reply Codes
Table 101

R EFFECTIVITY: ALL
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Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
11,000	2120	16,000	3020	19,000	7120
100	2130	100	3030	100	7130
200	2110	200	3010	200	7110
300	2510	300	3410	300	7510
400	2530	400	3430	400	7530
500	2520	500	3420	500	7520
600	2560	600	3460	600	7560
700	2540	700	3440	700	7540
800	2740	800	3640	800	7740
900	2760	900	3660	900	7760
12,000	2720	16,000	3620	20,000	7720
100	2730	100	3630	100	7730
200	2710	200	3610	200	7710
300	2310	300	3210	300	7310
400	2330	400	3230	400	7330
500	2320	500	3220	500	7320
600	2360	600	3200	600	7360
700	2340	700	3240	700	7340
800	2240	800	2240	800	7240
900	2260	900	3360	900	7260
13,000	2220	17,000	3320	21,000	7220
100	2230	100	3330	100	7230
200	2210	200	3310	200	7210
300	2610	300	3710	300	7610
400	2630	400	3730	400	7630
500	2620	500	3720	500	7620
600	2660	600	3760	600	7660
700	2640	700	3740	700	7640
800	2440	800	3640	800	7440
900	2460	900	3560	800	7460
14,000	2420	18,000	3520	22,000	7420
100	2430	100	3530	100	7430
200	2410	200	3510	200	7410
300	2010	300	3110	300	7010
400	2030	400	3130	400	7030
500	2020	500	3120	500	7020
600	2060	600	3160	600	7060
700	2040	700	3140	700	7040
800	3040	800	7140	800	5040
900	3060	900	7160	900	5060

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
23,000	5020	27,000	1120	31,000	1024
100	5030	100	1130	100	1034
200	5010	200	1110	200	1014
300	5410	300	1510	300	1414
400	5430	400	1530	400	1434
500	5420	500	1520	500	1424
600	5460	600	1560	600	1464
700	5440	700	1540	700	1444
800	5640	800	1740	800	1644
900	5660	900	1760	900	1664
24,000	5620	28,000	1720	32,000	1624
100	5630	100	1730	100	1634
200	5610	200	1710	200	1614
300	5210	300	1310	300	1214
400	5230	400	1330	400	1234
500	5220	500	1320	500	1224
600	5260	600	1360	600	1264
700	5240	700	1340	700	1244
800	5340	800	1240	800	1344
900	5360	900	1260	900	1364
25,000	5320	29,000	1220	33,000	1324
100	5330	100	1230	100	1334
200	5310	200	1210	200	1314
300	5710	300	1610	300	1714
400	5730	400	1630	400	1734
500	5720	500	1620	500	1724
600	5760	600	1660	600	1764
700	5740	700	1640	700	1744
800	5540	800	1440	800	1544
900	5560	900	1460	900	1564
26,000	5520	30,000	1420	34,000	1524
100	5530	100	1430	100	1534
200	5510	200	1410	200	1514
300	5110	300	1010	300	1114
400	5130	400	1030	400	1134
500	5120	500	1020	500	1124
600	5160	600	1060	600	1164
700	5140	700	1040	700	1144
800	1140	800	1044	800	5144
900	1160	900	1064	900	5164

M1-0000-34-2774

Mode C Reply Codes
Table 103

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
35,000	5124	39,000	7024	43,000	3124
100	5134	100	7034	100	3134
200	5114	200	7014	200	3114
300	5514	300	7414	300	3514
400	5534	400	7434	400	3534
500	5524	500	7424	500	3524
600	5564	600	7464	600	3564
700	5544	700	7444	700	3544
800	5744	800	7644	500	3744
900	5764	900	7664	900	3764
36,000	5724	40,000	7624	44,000	3724
100	5734	100	7634	100	3734
200	5714	200	7614	200	3714
300	5314	300	7214	300	3314
400	5334	400	7234	400	3334
500	5324	500	7224	500	3324
600	5364	600	7264	600	3364
700	5344	700	7244	700	3344
800	5244	800	7344	800	3244
900	5264	900	7364	900	3264
37,000	5224	41,000	7324	45,000	3224
100	5234	100	7334	100	3234
200	5214	200	7314	200	3214
300	5614	300	7714	300	3614
400	5634	400	7734	400	3634
500	5624	500	7724	500	3624
600	5664	600	7764	600	3664
700	5644	700	7744	700	3644
800	5444	800	7544	800	3444
900	5464	900	7564	900	3464
38,000	5424	42,000	7524	46,000	3424
100	5434	100	7534	100	3434
200	5414	200	7514	200	3414
300	5014	300	7114	300	3014
400	5034	400	7134	400	3034
500	5024	500	7124	500	3024
600	5064	600	7164	600	3064
700	5044	700	7144	700	3044
800	7044	800	3144	800	2044
900	7064	900	3164	900	2064

M1-0000-34-2776

Mode C Reply Codes
Table 104

R
R
001B

EFFECTIVITY: ALL

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
47,000	2024	51,000	6124	55,000	4024
100	2034	100	6134	100	4034
300	2414	300	6514	300	4414
400	2434	400	6534	400	4434
500	2424	500	6524	500	4424
600	2464	600	6564	600	4464
700	2444	700	6544	700	4444
800	2644	800	6744	800	4644
900	2664	900	6764	900	4664
48,000	2624	52,000	6724	56,000	4624
100	2634	100	6734	100	4634
200	2614	200	6714	200	4614
300	2214	300	6314	300	4214
400	2234	400	6334	400	4234
500	2224	500	6324	500	4224
600	2264	600	6364	600	4264
700	2244	700	3344	700	4244
800	2344	800	6344	800	4344
900	2364	900	6264	900	4364
49,000	2324	53,000	6224	57,000	4324
100	2334	100	6234	100	4334
200	2314	200	6214	200	4314
300	2714	300	6614	300	4714
500	2724	500	6624	500	4724
600	2764	600	6664	600	4764
700	2744	700	6644	700	4744
800	2544	800	6444	800	4544
900	2564	900	6464	900	4564
50,000	2524	54,000	6424	58,000	4524
100	2534	100	6434	100	4534
200	2514	200	6414	200	4514
300	2114	300	6014	300	4114
400	2134	400	6034	400	4134
500	2124	500	6024	500	4124
600	2164	600	6064	600	4164
700	2144	700	6044	700	4144
800	6144	800	4044	800	0144
900	6164	900	4064	900	0164
				59,000	0124

M1-0000-34-2775

Mode C Reply Codes
Table 105

3. Fault Isolation Identification

R Table 106 lists fault isolation diagrams and schematics in this
R section. Figures 101 and 102 provide component locations for
R ATC Transponder system.

Fault Isolation Diagrams and Schematics List
Table 106

	FIGURE NUMBER	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	BITE Check
	104	MODE A-B Checks
	105	Altitude Reporting Check
	106	Full Code Capability (Complement) Check
	106	Transponder Reply Codes and Pulse Spacing
R	SCHEM 1 (Sheet 1)	ATC Transponder Control Panel
R	SCHEM 1 (Sheet 2)	ATC Transponder No. 1 Schematic
R	SCHEM 1 (Sheet 3)	ATC Transponder Schematic (ATC-2, ADCs)

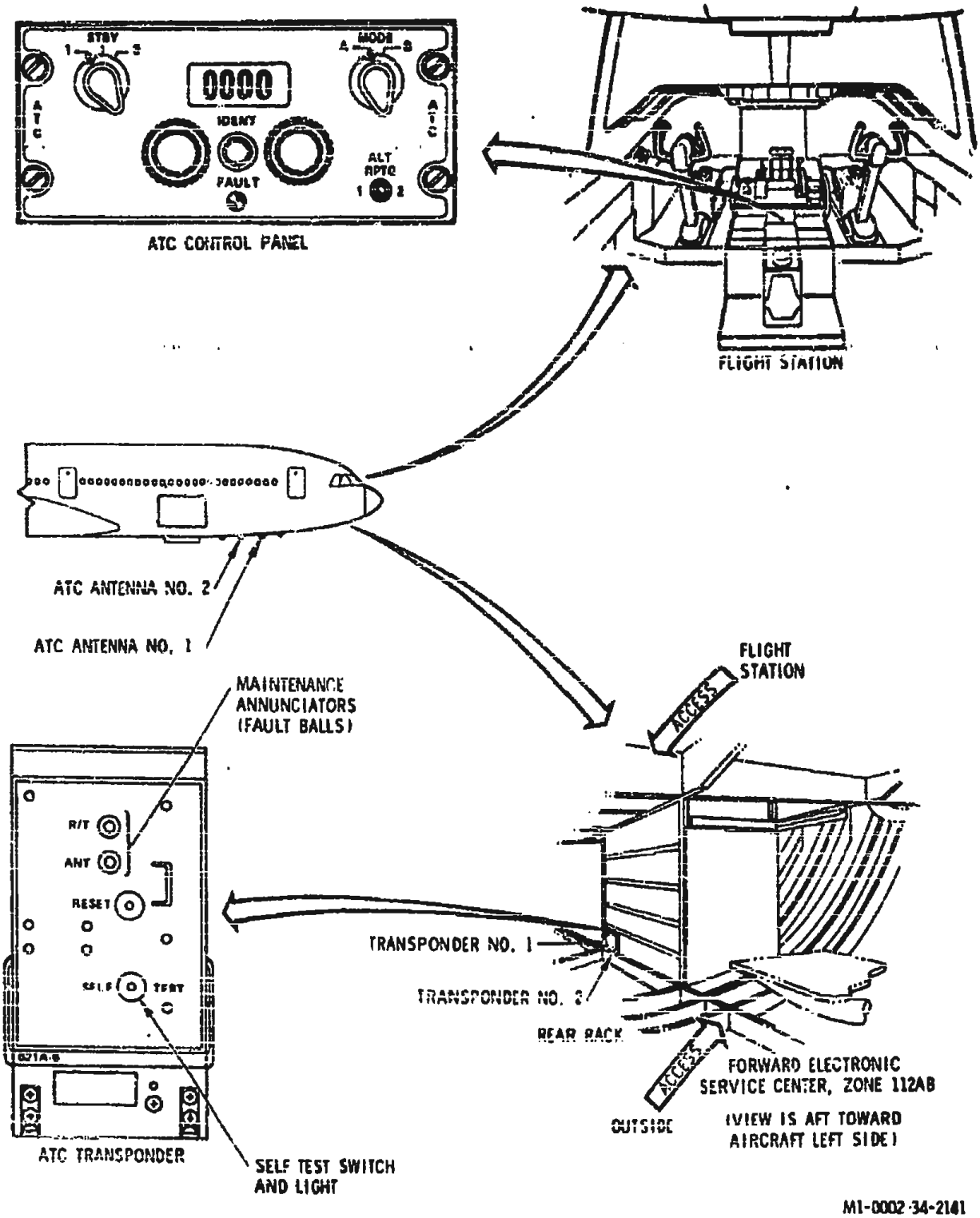
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA – ATC	2	FUS BOTTOM	34–53–03
PANEL – ATC CONTROL	1	FLT STA, CRT CSL	34–53–02
TRANSPONDER – ATC	2	FESC, REAR RACK/112AB	34–53–01

M1–0001–34–3362

R Component Location Index
R Figure 101

EFFECTIVITY: ALL

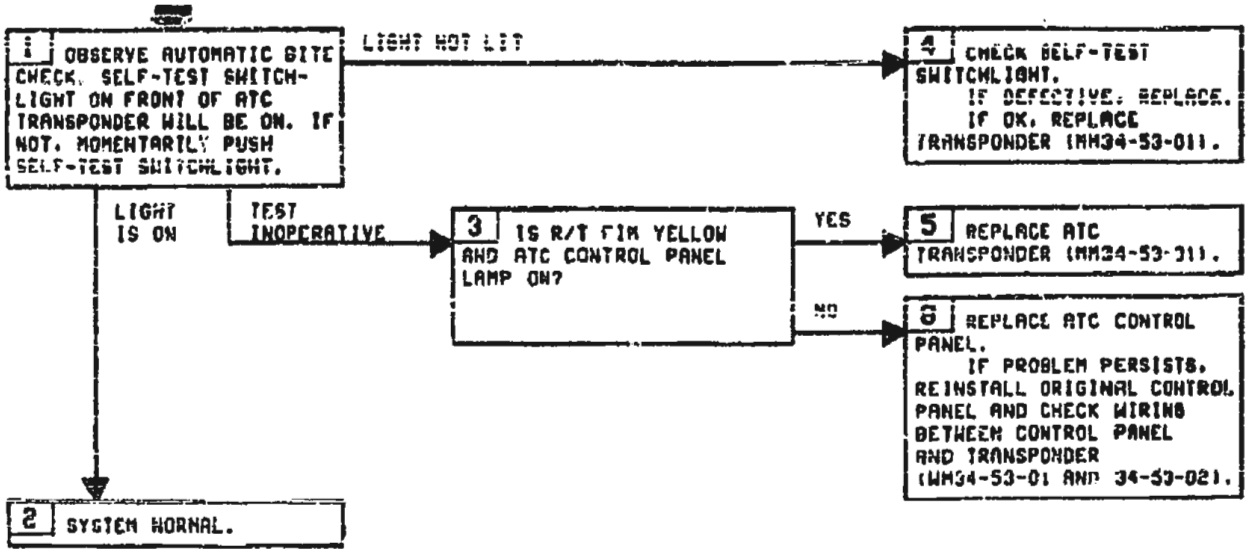
0016



Component Locator Diagram
Figure 102

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON
FE/SO ECS MONITOR PANEL ARE OUT
CB'S: 183, 182:
ATC DUAL CONTROL PANEL
SYSTEM SELECTOR 1 OR 2 DEPENDING ON SYSTEM UNDER TEST
MODE SELECTOR TO A
SELECTED CODE TO OTHER THAN 3100, 7600, OR 7700

BITE CHECK


1 OBSERVE AUTOMATIC BITE CHECK, SELF-TEST SWITCH-LIGHT ON FRONT OF ATC TRANSPONDER WILL BE ON. IF NOT, MOMENTARILY PUSH SELF-TEST SWITCHLIGHT.
LIGHT NOT LIT
4 CHECK SELF-TEST SWITCHLIGHT.
IF DEFECTIVE, REPLACE.
IF OK, REPLACE TRANSPONDER (MM34-53-01).
LIGHT IS ON
TEST INOPERATIVE
3 IS R/T FIM YELLOW AND ATC CONTROL PANEL LAMP ON?
YES
5 REPLACE ATC TRANSPONDER (MM34-53-01).
NO
6 REPLACE ATC CONTROL PANEL.
IF PROBLEM PERSISTS, REINSTALL ORIGINAL CONTROL PANEL AND CHECK WIRING BETWEEN CONTROL PANEL AND TRANSPONDER (MM34-53-01 AND 34-53-02).
2 SYSTEM NORMAL.

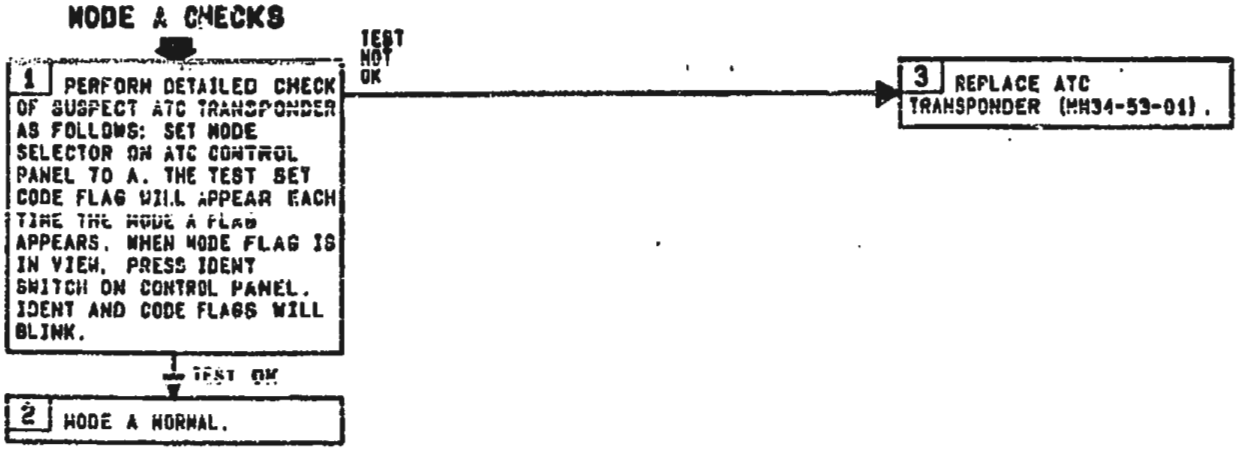
NOTE
FIM = FAULT ISOLATION MONITOR

A1-0004-34-1870

R ATC Transponder System - Bite Check
R Figure 103

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON FE/SC ECS MONITOR PANEL ARE OUT
CB'S: 193, 1823
ATC DUAL CONTROL PANEL
SYSTEM SELECTOR TO 1 OR 2 DEPENDING ON SYSTEM UNDER TEST
ALT RPTG 1/2 TO CENTER (OFF)
SELECTED CODE TO CODE SET ON TEST SET
478X-3 TEST SET: PERFORM SELF-TEST AC PER INSTRUCTIONS IN TEST SET COVER
LOCATE TEST SET WITH COVER (ANTENNA) FACING AIRCRAFT ATC ANTENNA
SET T/R ATTEN CONTROL AS PER INSTRUCTIONS IN TEST SET COVER
SET PREDETERMINED TEST CODE
SET MODE SELECTOR TO A-B-C

MODE A CHECKS

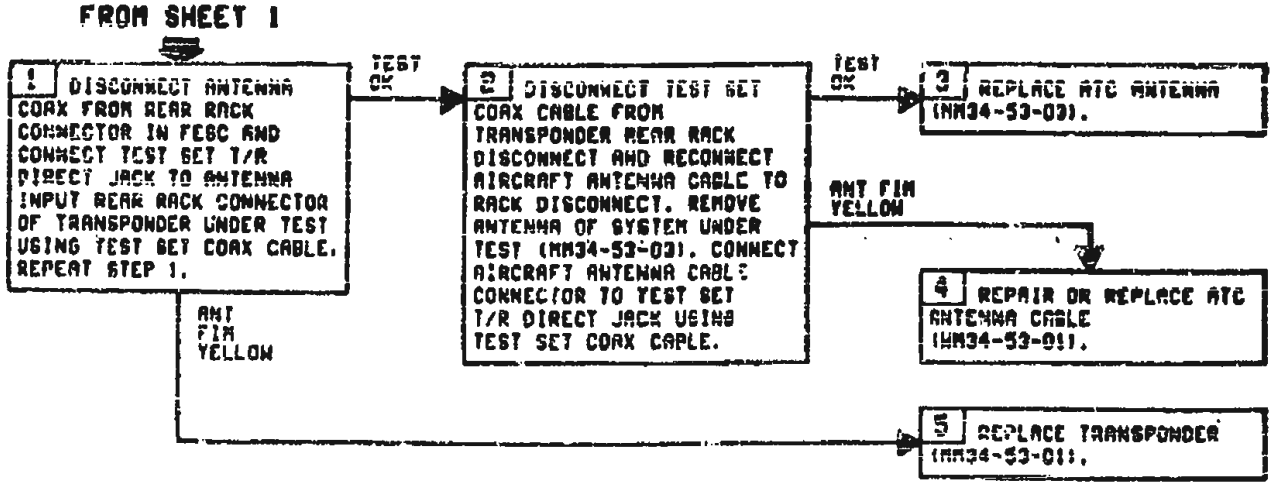

1 PERFORM DETAILED CHECK OF SUSPECT ATC TRANSPONDER AS FOLLOWS: SET MODE SELECTOR ON ATC CONTROL PANEL TO A. THE TEST SET CODE FLAG WILL APPEAR EACH TIME THE MODE A FLAG APPEARS. WHEN MODE FLAG IS IN VIEW, PRESS IDENT SWITCH ON CONTROL PANEL. IDENT AND CODE FLAGS WILL BLINK.
TEST NOT OK
3 REPLACE ATC TRANSPONDER (MM34-53-01).
TEST OK
2 MODE A NORMAL.

NOTE
ALLOW EACH TRANSPONDER TO WARM UP FOR 5 MINUTES BEFORE STARTING TEST
CHECK THAT FM'S ON TRANSPONDER FRONT PANEL ARE BLACK

M1-0018-34-1078

R ATC Transponder System - MODE A-B Checks
R Figure 104 (Sheet 1)

PREREQUISITES
SEE SHEET 1

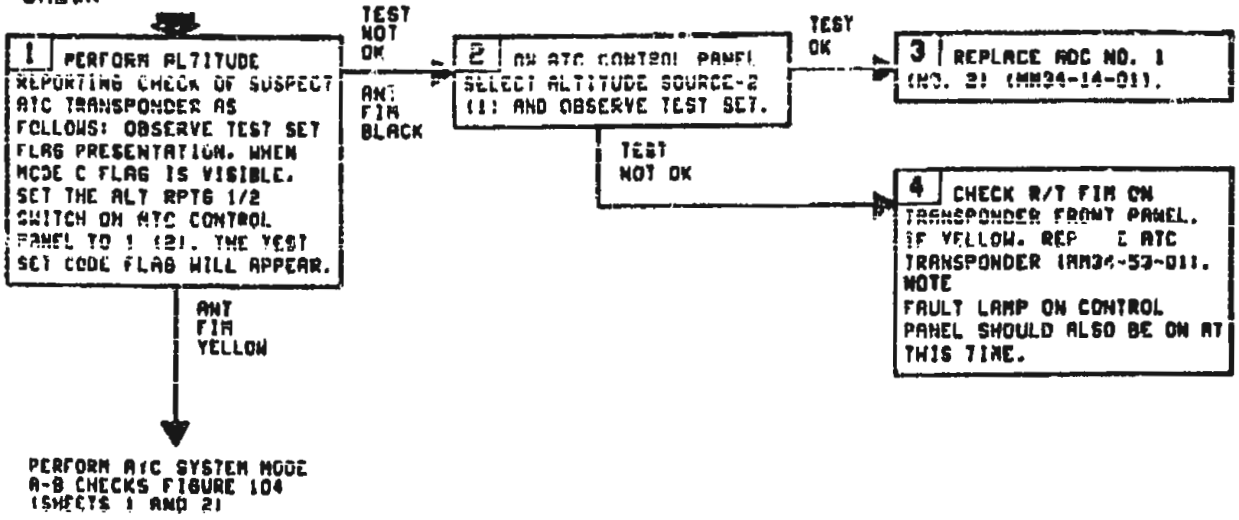

FROM SHEET 1
1 DISCONNECT ANTENNA COAX FROM REAR RACK CONNECTOR IN FESC AND CONNECT TEST SET T/R DIRECT JACK TO ANTENNA INPUT REAR RACK CONNECTOR OF TRANSPONDER UNDER TEST USING TEST SET COAX CABLE. REPEAT STEP 1.
TEST OK
2 DISCONNECT TEST SET COAX CABLE FROM TRANSPONDER REAR RACK DISCONNECT AND RECONNECT AIRCRAFT ANTENNA CABLE TO RACK DISCONNECT. REMOVE ANTENNA OF SYSTEM UNDER TEST (MM34-53-03). CONNECT AIRCRAFT ANTENNA CABLE CONNECTOR TO TEST SET T/R DIRECT JACK USING TEST SET COAX CABLE.
TEST OK
3 REPLACE ATC ANTENNA (MM34-53-03).
ANT FIM YELLOW
4 REPAIR OR REPLACE ATC ANTENNA CABLE (MM34-53-01).
ANT FIM YELLOW
5 REPLACE TRANSPONDER (MM34-53-01).

R1-0001-34-1357

R ATC Transponder System - MODE A-B Checks
R Figure 104 (Sheet 2)

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON FE/SO
ECS MONITOR PANEL ANE OUT
CB'S: 183, 188, 1821, 1827
ATC DUAL CONTROL PANEL
SYSTEM SELECTOR TO 1 OR 2 DEPENDING ON SYSTEM UNDER TEST
ALT RPTG 1/2 SWITCH INITIALLY OFF (CENTER)
SELECTED CODE TO CODE SET ON TEST SET
ALT RPTG SWITCH TO EITHER 1 OR 2
476X-3 TEST SET: PERFORM SELF TEST PER
INSTRUCTIONS IN TEST SET COVER
LOCATE TEST SET WITH COVER (ANTENNA) FACING AIRCRAFT ATC ANTENNA
SET T/R ATTEN CONTROL PER INSTRUCTIONS IN TEST SET COVER
SET PREDETERMINED TEST CODE
SET MODE SELECTOR TO A-B-C

ALTITUDE REPORTING CHECK


1 PERFORM ALTITUDE REPORTING CHECK OF SUSPECT ATC TRANSPONDER AS FOLLOWS: OBSERVE TEST SET FLAG PRESENTATION. WHEN MODE C FLAG IS VISIBLE, SET THE ALT RPTG 1/2 SWITCH ON ATC CONTROL PANEL TO 1 (2). THE TEST SET CODE FLAG WILL APPEAR.
TEST NOT OK
ANT FLAG BLACK
2 ON ATC CONTROL PANEL SELECT ALTITUDE SOURCE-2 (1) AND OBSERVE TEST SET.
TEST OK
3 REPLACE ADC NO. 1 (NO. 2) (MM34-14-01).
TEST NOT OK
4 CHECK R/T FLAG ON TRANSPONDER FRONT PANEL. IF YELLOW, REP E ATC TRANSPONDER (MM34-53-01).
NOTE
FAULT LAMP ON CONTROL PANEL SHOULD ALSO BE ON AT THIS TIME.
ANT FLAG YELLOW
PERFORM ATC SYSTEM MODE A-B CHECKS FIGURE 104 (SHEETS 1 AND 2)

RI-0003-34-1099

R ATC Transponder System - Altitude Reporting Check
R Figure 105

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING: VERIFY AVIONICS AIR - FWD AND MID LO FLO LIGHTS ON FE/80
ECS MONITOR PANEL ARE OUT
CB'S: 83, 88, 824, 827
ATC DUAL CONTROL PANEL
SYSTEM SELECTOR TO 1 OR 2 DEPENDING ON SYSTEM UNDER TEST
SELECTED CODE TO COMPLEMENT OF TEST CODE
(7777 MINUS TEST CODE) 478X-3 TEST SET
PERFORM SELF TEST PER INSTRUCTIONS IN TEST SET COVER
LOCATE TEST SET WITH COVER (ANTENNA) FACING AIRCRAFT ATC ANTENNA
SET T/R ATTEN CONTROL PER INSTRUCTIONS IN TEST SET COVER
SET PREDETERMINED TEST CODE
SET MODE SELECTOR TO A-B-C

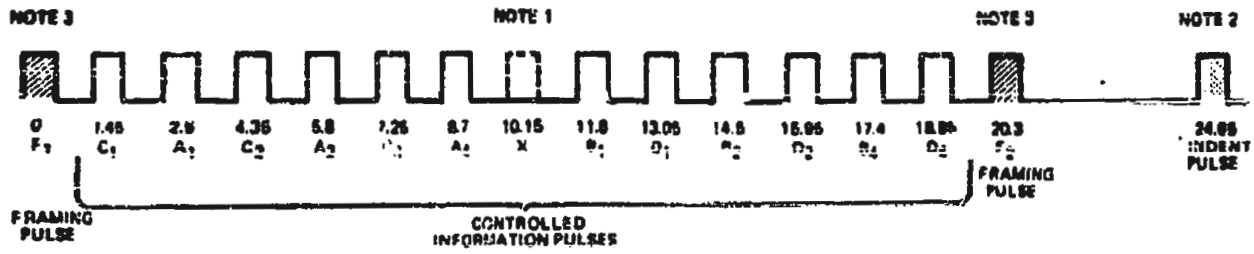
FULL CODE CAPABILITY CHECK

1 PERFORM FULL CODE CAPABILITY TEST AS FOLLOWS: CONTROL PANEL MODE SELECTOR TO A. CODE FLAG SHOULD APPEAR WHEN TEST SET MODE A FLAG IS SHOWING.
TEST NOT OK
3 REPLACE ATC TRANSPONDER (MM34-53-01).
TEST OK
2 FULL CODE CAPABILITY NORMAL.

NOTE
THIS TEST CHECKS THE FULL CODE CAPABILITY OF THE TRANSPONDER UNDER TEST

M1-0002-34-1001

R ATC Transponder System - Full Code Capability (Complement) Check
R Figure 106



REPLY TRAIN (MAXIMUM REPLY CODE 7777 AND IDENT PULSE SHOWN)

SPACING IN USEC FROM LEADING EDGE OF F_1 TO LEADING EDGE OF EACH PULSE

PULSE NOMENCLATURE

BASIC CODE TABLE

DIGIT	INFORMATION PULSE ASSIGNMENT			
	THOUSANDS (A)	HUNDREDS (B)	TENS (C)	UNITS (D)
0	NONE	NONE	NONE	NONE
1	A_1	B_1	C_1	D_1
2	A_2	B_2	C_2	D_2
3	A_1 A_2	B_1 B_2	C_1 C_2	D_1 D_2
4	A_4	B_4	C_4	D_4
5	A_1 A_4	B_1 B_4	C_1 C_4	D_1 D_4
6	A_2 A_4	B_2 B_4	C_2 C_4	D_2 D_4
7	A_1, A_2, A_4	B_1, B_2, B_4	C_1, C_2, C_4	D_1, D_2, D_4

MI-0000-34-667

Transponder Reply Codes and Pulse Spacing
Figure 107 (Sheet 1)

USE BASIC CODE TABLE TO DETERMINE INFORMATION PULSES SELECTED FOR EACH OF THE 4096 CODE NUMBERS ON THE CONTROL HEAD AS PER THE FOLLOWING EXAMPLES:

	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
CONTROL HEAD CODE NUMBER	0	0	0	0	0	0	1	2	3	6	0	0	0	4	7	5	7	7	7	7
INFORMATION PULSES SELECTED	FRAMING PULSES ONLY						C_1	D_2	A_1	B_2				B_4	C_1	D_1	A_1	B_1	C_1	D_1
									A_2	B_4					C_2	D_4	A_2	B_2	C_2	D_2
															C_4		A_4	B_4	C_4	D_4

NOTE

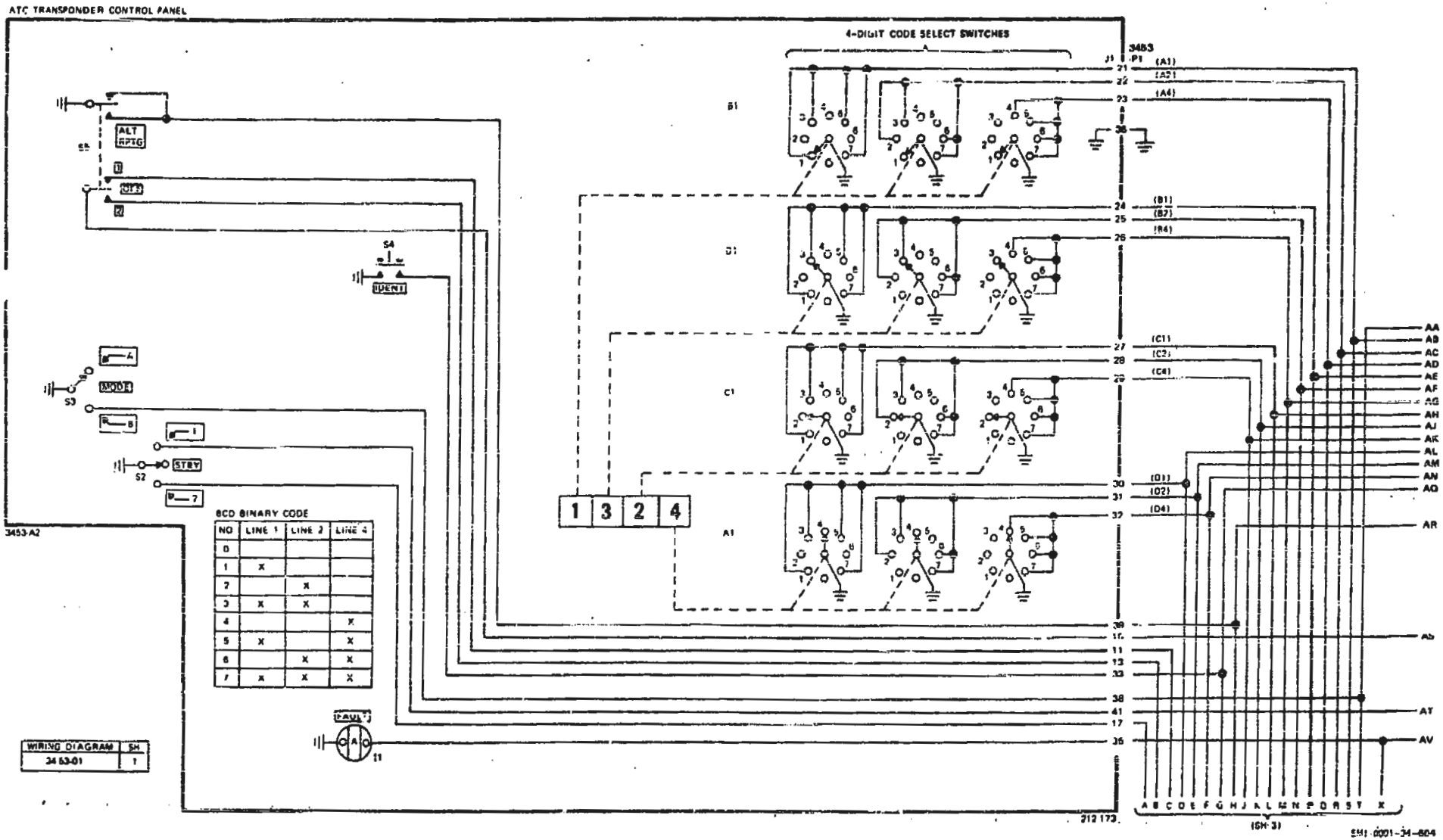
1 X PULSE NOT USED IN PRESENT CODING; PULSE FUNCTION IS PROVIDED IN 914 AND CAN BE SELECTED FROM REAR CONNECTOR

2 IDENTIFICATION PULSE PRESENT ONLY WHEN SELECTED BY ACTUATING THE IDENT SWITCH

3 FRAMING PULSES F_1 AND F_2 ALWAYS PRESENT IN REPLY TRAIN

M1-0000-34-658

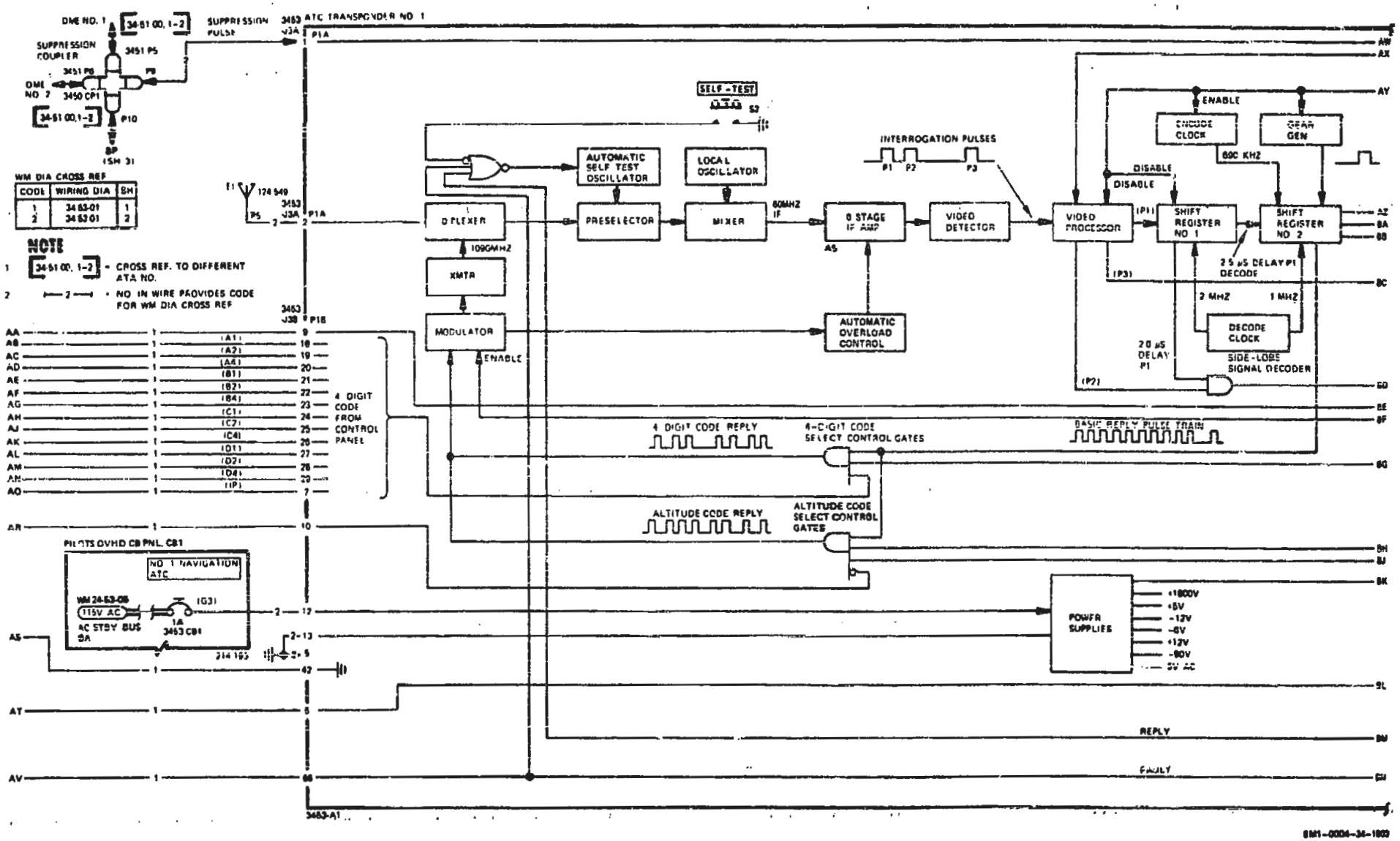
Transponder Reply Codes and Pulse Spacing
Figure 107 (Sheet 2)



R ATC Transponder Control Panel Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

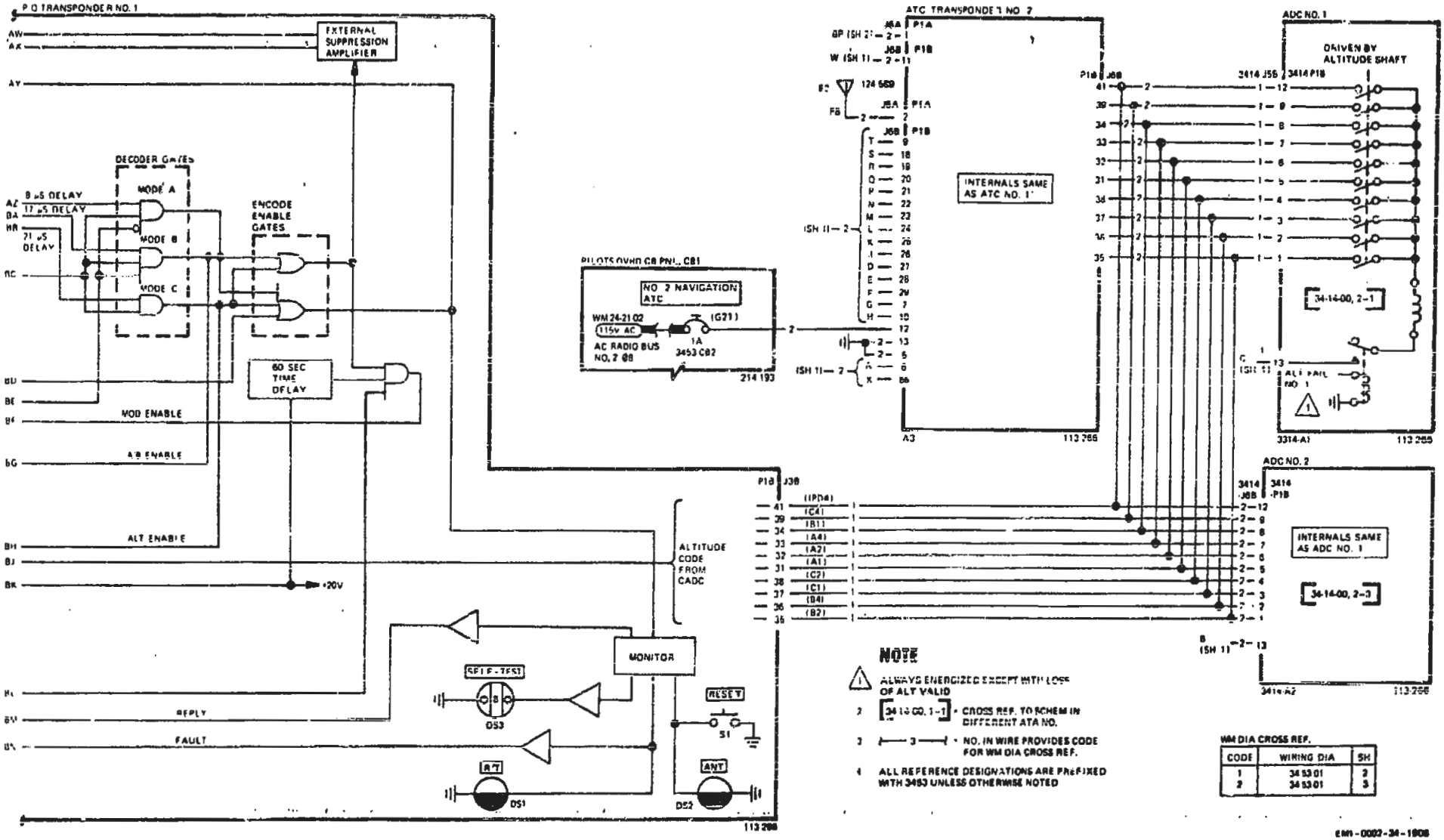
0018



ATC Transponder System No. 1 Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

0018



NOTE

1. ALWAYS ENERGIZED EXCEPT WITH LOSS OF ALT VALID
2. [34-14-00, 1-1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. —3— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4. ALL REFERENCE DESIGNATIONS ARE PREFIXED WITH 3453 UNLESS OTHERWISE NOTED

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	345301	2
2	345301	3

emn-0002-34-1908

R ATC Transponder System Schematic (ATC-2, ADCs)
R SCHEM 1 (Sheet 3)

EFFECTIVITY: ALL

C AIR TRAFFIC CONTROL TRANSPONDER (ATC) SYSTEM - ADJUSTMENT/TEST

C 1. Operational Test (Self Test) - ATC System

C A. General

C (1) The following paragraph provides a step-by-step
C operational test procedure for the ATC system.

C (2) Equipment required:

C Pitot/Static Tester or altitude reporting test set
C 34-53-01-0053

C ATC Transponder Tester

C NOTE: Refer to these equipment instructions, if
C required.

C WARNING: DO NOT SELECT CODES 7777, 7700, 7600 or 7500 ON THE
C AIRCRAFT ATC CONTROL UNIT. THEY ARE FOR CERTAIN
C EMERGENCY CODES.

C B. Test System

C (1) Provide electrical power.

C (2) On pilots overhead circuit breaker panel CB-1, verify
C that circuit breakers No. 1 NAVIGATION-ATC and No. 2
C NAVIGATION-ATC are closed.

C (3) Turn function selector switch on ATC control module to
C STBY and allow at least 1 minute warm up time.

CR (4) Set function selector switch on ATC control module to
C No. 1 position.

C (5) Set mode switch on ATC control module to mode A.

C NOTE: In the following tests the TEST light may
C already be glowing if the transponder is being
C interrogated by the ATC radar beacon and is
C replying to same.

C (6) On ATC transponder No. 1 in forward electronic service
C center, depress TEST button and verify that TEST light
C glows.

C (7) Release TEST button.

CR (8) Set function selector switch to No. 2 position.

C (9) On ATC transponder No. 2 in forward electronic service center, depress TEST button and verify that TEST light glows.

C (10) Release TEST button.

C (11) Perform Altitude Reporting Test, Para. 2.B. or 2.C..

C (12) Remove electrical power if no longer required.

C 2. Operational Test - Air Traffic Control (ATC) System

C A. Preparation for Test

C (1) On pilots overhead circuit breaker panel CB-1, verify that the following circuit breakers are closed:

C NO. 1 NAVIGATION-ATC

C NO. 1 NAVIGATION-AIR DATA CMPTR

C NO. 1 INSTRUMENT-ALTM

C NO. 2 NAVIGATION-ATC

C NO. 2 NAVIGATION-AIR DATA CMPTR

C NO. 2 INSTRUMENT-ALTM

C B. Operational Test - ATC System - Using Collins 476X-3 Test Set

C (1) Prepare for Test

C (a) Set 476X-3 mode selector switch to A-B-C and verify that mode flags indicate A to B to C in sequence.

C (b) Set mode selector switch to self-test position. Set T/R ATTEN control to 25 DB. Observe that meter indicates to the right of RECHARGE. If meter indicates to the left of RECHARGE, the battery must be recharged before tester is used.

C (c) Calibrate the R-F output by setting mode selector to SELF-TEST. Position calibrate output-battery voltage switch in CALIBRATE OUTPUT position, and adjust output to obtain a red-line indication on meter.

C (d) Self-test by setting mode selector switch to
C SELF-TEST, and setting T-R ATTEN control to 25 DB.
C Observe that IDENT FLAGS appear.

C (e) Set code selector to 0000. Observe that CODE and
C IDENT flags appear in steady state.

C (f) Set code 7777. Observe that CODE and IDENT flags
C appear in steady state.

C (g) Set code 7773. Observe that CODE flag blinks;
C IDENT flag appears in steady state.

C (h) Set code 0004. Observe that CODE flag blinks;
C IDENT flag appears in steady state.

C (i) Place test set in a position such that test set
C antenna is in view of aircraft antennas.

C NOTE: There must be no objects or personnel
C between the ramp test set and the aircraft
C ATC radar beacon antenna.

C (j) With electrical power on the aircraft and both
C radio bus switches closed, check that circuit
C breakers for both ATC systems and both air data
C instrumentation systems are activated.

C WARNING: REFER TO PRECAUTIONS IN CHAPTER 34-13-00,
C PAGE 520, PRIOR TO OPERATING PITOT-STATIC
C EQUIPMENT FOR THESE TESTS.

C (k) Position the switches on the aircraft ATC control
C panel as follows:

CR 1) Function switch - STBY

C 2) Mode Selector Switch - Mode A

C (l) Set the applicable altimeter to 29.92.

CR (m) Select function switch to ATC No. 1 or No. 2 and
C ALT RPTG source No. 1 or No. 2 on the ATC control
C unit, as applicable.

C (n) Connect the Pitot/Static tester to the applicable
C system, or disconnect the applicable CADC from
C rack connectors and install the 34-53-01-0053
C altitude reporting test set connector into the
C bottom rack connector.

CR CR C (o) Adjust the Pitot-Static or altitude reporting tester until the ATC transponder tester indicates the following altitudes are being reported:

2300	2500	3800	4300
4800	6800	14800	30800

CR C C (p) If using the pitot/static tester at each altitude, the applicable altimeter must indicate the designated altitude ±125 feet.

C C C C C C NOTE: As each altitude code segment on the encoder is 100 feet wide, the altimeter reading may be increased or decreased to see if ±125 feet tolerance can be met PROVIDED the transponder tester continues to read the designated altitude.

C C (q) Turn the ramp test unit mode selector switch to the OFF position.

C (r) Turn OFF the radio bus switches on the aircraft.

C C C (s) Determine whether there is further need for external power on the aircraft and if not, remove the external power.

C C. Operational Test - ATC System - Using TEL-Instruments T33B Test Set

C (1) Prepare for Test

CR CR (a) Place test set in a position such that test set antenna is in view of aircraft antennas.

C C C NOTE: There must be no objects or personnel between the ramp test set and the aircraft ATC radar beacon antenna.

C C C C (b) With electrical power on the aircraft and both radio bus switches closed, check that circuit breakers for both ATC systems and both air data instrumentation systems are activated.

C C C C WARNING: REFER TO PRECAUTIONS IN CHAPTER 34-13-00, PAGE 502, PRIOR TO OPERATING PITOT-STATIC EQUIPMENT FOR THESE TESTS.

C C (c) Position the switches on the aircraft ATC control panel as follows:

CR 1) Function Switch - STBY

C 2) Mode Selector Switch - MODE A

C (d) Set the applicable altimeter to 29.92.

CR (e) Select function switch to ATC No. 1 or No. 2 and
C ALT RPTG source No. 1 or No. 2 on the ATC control
C unit, as applicable.

C (f) Connect the Pitot/Static tester to the applicable
C system, or disconnect the applicable CADC from
C rack connectors and install the 34-53-01-0053
C altitude reporting test set connector into the
C bottom rack connector.

C (g) Adjust the Pitot/Static tester or altitude
C reporting tester until the ATC transponder tester
C indicates the following altitudes are being
C reported:

2300	2500	3800	4300
4800	6800	14800	30800

C (h) If using the pitot/static tester at each altitude,
C the applicable altimeter must indicate the
C designated altitude ±125 feet.

C NOTE: See if ±125 feet tolerance can be met
C PROVIDED the transponder tester continues
C to read the designated altitude.

C Place the MODE switch on the test set to
C mode C and place READOUT switch to
C ALTITUDE. Hold POWER switch ON. The
C readout windows should indicate the
C altitude as indicated by the altimeters ±75
C feet. The READOUT switch may be changed to
C the PILOTS position and the test set will
C indicate the altitude transmission code for
C the indicated altitude.

C The READOUT selector may be placed in the
C BINARY position and will indicate the
C actual number of A-B-C-D pulses
C transmitted. The tester will add 400,000
C feet to altitude if any invalid C pulses
C are present (C_2 - C_4 - C_1), 200,000 feet if
C any invalid D pulses are present (D_1 - D_2 -
C D_4 - D_1), and 600,000 feet if both
C erroneous C and D bits are present.

When there is no Mode C information, such as would occur with a disconnected digitizer, the T-33B altitude readout will be 4007. This can be verified by setting the T-33B readout switch to PILOT. A display of 0000 will be indicated.

(i) Secure ramp test equipment.

(j) Turn OFF the radio bus switches on the aircraft.

(k) Determine whether there is further need for external power on the aircraft and if not, remove the external power.

D. Test ATC System Using 476X-3 Test Set

NOTE: Proceed to Paragraph E for test procedure using T-33B Test Set.

(1) With test set T/R ATTN DB control is position 0, place mode selector switch on test set to MODE A. A steady code flag (fluorescent orange) should be indicated on the test set.

NOTE: If a steady CODE flag does not appear, this signifies an aircraft system malfunction. However, the beam width of the ramp test unit signal is narrow and the absence of the CODE flag may indicate improper positioning of the test unit. Tilt and/or turn the ramp test unit slightly and repeat the test.

(2) Change the test code selection on both the ATC control panel and the test set to the test code complement. Complement of test code is 7777 minus test code being used. This checks the full code capability of the transponder under test.

EXAMPLE: If Test Code being used is 0340, the complement is:

```
 7777
-0340
```

7437 Complement

(3) Place the mode selector switch on the ATC control panel and the mode selector switch on the ramp test unit in the B position. A steady CODE flag should be indicated.

(4) Return both mode selector switches to the A position and change test code selection on both the ATC control panel and test set back to the original test code.

(5) Push the IDENT button located on the aircraft ATC control panel. Both CODE and IDENT flags on the test set should appear in blinking state for approximately 20 seconds. A steady presentation of the CODE and IDENT flags during this period indicates ident pulse operation is normal but sidelobe suppression circuits are malfunctioning. Absence of an ident flag indicates ident pulse is malfunctioning.

(6) Place the mode switch on the test set to MODE C position and the Alt Rptg Source switch on the ATC control panel to the NO. 1 position. A steady code flag should appear on the test set indicating the altitude reporting function is functioning.

NOTE: If a steady code flag does not appear, re-test with the test set and control panel code switches set to the next higher and then the next lower altitude code (next 100 foot increment above and below altimeter reading), as indicated in the Altitude Reporting Code, Table 501. If a steady CODE flag is not indicated in one of the three tests, the altitude reporting function is malfunctioning.

(7) Repeat Step (6) with the Alt Rptg Sources switch on the aircraft ATC control panel placed in the NO. 2 position.

(8) Return the Alt Rptg Source switch to the NO. 1 position, place the ATC T/R switch on the aircraft ATC control panel to the NO. 2 position.

(9) Test the NO. 2 ATC system as outlined in Steps (1) through (8).

(10) Turn the ramp test unit mode selector switch to the OFF position.

(11) Turn OFF the radio bus switches on the aircraft.

(12) Determine whether there is further need for external power on the aircraft if not, remove the external power.

CR E. ATC System TEST using T33-B Test Set.

CR NOTE: This system test is a complete checkout of the ATC
CR system. It is to be performed during periodic
CR maintenance periods (Check C or Base Overhaul) when
CR specified on the work cards as a F.A.R. requirement.

CR (1) Transponder Receiver Sensitivity Test (Preferred
CR Method)

CR (a) Connect EQ1172-300 ATC Antenna hatbox to BNC Jack
CR "J5-ATC DIRECT" on test set. Ensure that
CR protective cap is installed on TNC Jack "J3-TEST
CR SET ANT" to prevent direct radiation of signals.

CR (b) Set the T-33B controls as follows:

CR Receiver/Sensitivity - Mid Scale

CR 1090 MHz - Zero

CR Reply/SLS - 100%

CR Mode - A

CR Readout - Pilot

CR (c) Turn on the T-33B tester. Ascertain the battery
CR check meter is in the white portion of the scale.
CR If not, recharge the battery from the 115V AC
CR 60-400 Hz source.

CR NOTE: It is permissible to operate the T-33B
CR tester while the battery is being charged.

CR (d) Place the EQ1172-300 ATC Antenna hatbox directly
CR over the No. 1 ATC Antenna. Set the
CR receiver/sensitivity control to obtain a meter
CR reading, then vary the position of the hatbox in
CR relation to the ATC antenna to find the point of
CR strongest signal coupling. Maintain this position
CR through step (f).

CR (e) Adjust the receiver/sensitivity control for a
CR meter reading of 90%. The sensitivity as read on
CR the dial must be -72 (±4) DBM.

CR (f) Select Mode C on the T-33B tester. Repeat Step
CR (e). The sensitivity must be within one DB of the
CR Mode A sensitivity. Return the control to Mode A
CR and remove test set antenna hatbox.

CR CR CR NOTE: Mode C is activated on the ATC transponder at all times whether selected on the control unit or not.

CR CR (g) Repeat steps (b) through (f) for the No. 2 ATC system.

CR CR CR (h) Remove the EQ1172-300 ATC Antenna hatbox from the tester and connect test set antenna to TNC jack "J3-TEST SET ANT" with test cable EQ-1172-200.

CR CR CR CR CR NOTE: If the EQ1172-300 ATC Antenna hatbox is unavailable, or if a problem is encountered in acquiring a sufficiently stable reading, the following alternate receiver sensitivity test may be performed.

CR CR (2) Transponder Receiver Sensitivity Test (Alternate Method)

CR (a) Remove the No. 1 ATC antenna.

CR C (b) Using a T33-B tester ONLY, connect the antenna end of the transmission line to the tester as follows:

CR C • Connect the six foot test cable to the BNC jack on the tester.

C C C C C C C CAUTION: NEVER CONNECT THE TEST CABLE TO THE TNC CONNECTOR ON THE TESTER AS THE TESTER WILL BE DAMAGED. ALSO, THE ANTENNA (IN THE COVER) MUST BE DISCONNECTED FROM THE TNC JACK AND THE PROTECTOR CAP MUST BE INSTALLED ON THIS TNC CONNECTOR TO PREVENT RADIATION OF SIGNALS.

CR C C • Using the proper between-series adapter, connect the other end of the test cable to the transmission line.

CR C (c) Set the T33-B controls as follows:

C Receiver/Sensitivity - Mid Scale

C 1090 MHz - Zero

C Reply/SLS - 100%

C Mode - A

C Readout -Pilot

(d) Turn on the T33-B tester. Ascertain the BATTERY CHECK meter is in the white portion of the scale. If not, recharge the battery from a 115V AC 50-500 Hz source.

NOTE: It is permissable to operate the T33-B tester while the battery is being charged.

(e) Adjust the RECEIVER/SENSITIVITY control for a meter reading between 90 and 100%. The sensitivity as read on the dial must be -72 (±4) DBM.

(f) Select MODE C on the T33-B tester. Repeat Step 2E(2)(e). The sensitivity must be within 1 DB of the MODE A sensitivity. Return the controls to MODE A.

(g) Disconnect the tester. Connect and reinstall the No. 1 ATC antenna.

(h) Repeat Steps 2E(1) through 2E(2)(g) for the No. 2 ATC system.

NOTE: The following tests will suffice for all but tests required to meet Federal Aviation Regulations [Refer to NOTE preceding Paragraph 2E(1)].

(3) With test set SENSITIVITY control set to maximum, REPLY/SLS set to LEVEL, and 1090 MHz control set to "0", place MODE selector switch on test set to MODE 3/A, place READOUT switch to PILOT. Hold POWER switch ON. The test set meter should deflect indicating a reply from the transponder. The test set readout should indicate the code set up in Step 2.C(3)(c). The test set meter should deflect at least full scale for proper operation of code circuits.

NOTE: If correct indications do not appear, assure that the test set antenna is coupling to the transponder antenna. The 1090 MHz control may be adjusted + or - from zero to adjust test set frequency to transponder frequency. Limit of adjustment is ±6 MHz.

(4) Change the test code selection on the ATC control panel to the test code complement. Complement of test code is 7777 minus test code being used. This checks the full code capability of the transponder under test.

EXAMPLE: If test code being used is 0340, the complement is:

7777
-0340

7437 complement.

(5) Place the MODE selector switch on the ATC control panel and the mode selector switch on the ramp test unit in the B position. Hold POWER switch ON. The test set should indicate the complement code.

(6) Return both MODE selector switches to the A position and change the test code selection on the ATC control panel back to the original test code.

(7) Adjust the RECEIVER/SENSITIVITY control so that meter deflection is about 1/4 scale. Adjust the 1090 MHz control on the T-33B for MAXIMUM meter deflection. Best resolution of this adjustment is made at 1/4 scale or less; adjust the T-33B sensitivity accordingly. Read transmitter frequency error directly from the dial. Maximum error permissible is (±) 3 MHz.

(8) To check transponder reply rate throw the REPLY/SLS switch to the 100% position. The T-33B meter now indicates the reply rate as a percentage of the interrogation rate, with full scale of 100% position. A properly operating transponder must reply with a rate of 90% or greater. Note that the T-33B readout indicates the presence of framing pulses in the reply.

(9) To check the SLS circuits of the transponder throw the REPLY/SLS switch to the 10%/0 dB position. The meter, will full scale equal to 10%, should read 1.3% or less for a properly operating transponder. Note that the T-33B readout extinguishes, indicating that the transponder is not replying to the interrogation.

CAUTION: SOME TRANSPONDERS, WHEN RECEIVING A SIGNAL NEAR MTL (MINIMUM TRIGGERING LEVEL), MAY TRANSMIT A REPLY EVEN THOUGH THE SLS PULSE IS PRESENT IN THE INTERROGATION. IF A REPLY IS RECEIVED WITH THE SLS PULSE AT 0 DB, REPEAT THE SLS TEST WITH THE T-33B PLACED CLOSER TO THE TRANSPONDER ANTENNA TO INCREASE THE SIGNAL STRENGTH.

(10) Turn SLS to -9 dB. Push the READOUT switch to PILOT and note the indication of the presence of the framing pulses. Push the tranponder IDENT button and note the

C presence of the Ident (SPIP) pulse which should be
C present for approximately 20 seconds.

CR (11) Place the MODE switch on the test set to mode C, place
C READOUT switch to ALTITUDE and place the ALT RPTG
C source switch on the ATC control panel to the No. 1
C position. Hold POWER switch ON, the readout windows
C should indicate the field elevation as indicated by the
C altimeters ± 75 feet. The READOUT switch may be
C changed to the PILOTS position and the test set will
C indicate the altitude transmission code for the
C indicated altitude.

C NOTE (1): The READOUT selector may be placed in the
C BINARY position and will indicate the actual number of
C A-B-C-D pulses transmitted. The tester will add
C 400,000 feet to altitude if any invalid C pulses are
C present (C0 - C5 - C7), 200,000 feet if any invalid D
C pulses are present (D1 - D3 - D5 - D7), and 600,000
C feet if both erroneous C and D bits are present.

C NOTE (2): When there is no Mode C information, such as
C would occur with a disconnected digitizer, the T-33B
C altitude readout will be 4007. This can be verified by
C setting the T-33B readout switch to PILOT. A display
C of 0000 will be indicated.

CR (12) Repeat Step (11) with the ALT RPTG source switch on the
C ATC control panel placed in the No. 2 position.

CR (13) On ATC control panel, place ALT RPTG source switch OFF,
C 1-STBY-2 switch to No. 2 position.

CR (14) Test the No. 2 ATC system as outlined in Steps (3) thru
CR (12).

CR (15) Secure ramp test equipment.

CR (16) Turn OFF the radio bus switches on the aircraft.

CR (17) Determine whether there is further need for external
C power on the aircraft and if not, remove the external
C power.

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
-1,000	0020	3,000	4120	7,000	6020
-900	0030	3,100	4130	7,100	6030
-800	0010	3,200	4110	7,200	6010
-700	0410	3,300	4610	7,300	6410
-600	0430	3,400	4630	7,400	6430
-500	0420	3,500	4620	7,500	6420
-400	0460	3,600	4660	7,600	6460
-300	0440	3,700	4640	7,700	6440
-200	0640	3,800	4740	7,800	6640
-100	0660	3,900	4760	7,900	6660
000	0620	4,000	4720	8,000	6620
100	0630	4,100	4730	8,100	6630
200	0610	4,200	4710	8,200	6610
300	0210	4,300	4310	8,300	6210
400	0230	4,400	4330	8,400	6230
500	0220	4,500	4320	8,500	6220
600	0260	4,600	4360	8,600	6260
700	0240	4,700	4340	8,700	6240
800	0340	4,800	4240	8,800	6340
900	0360	4,900	4260	8,900	6360
1,000	0320	5,000	4220	9,000	6320
1,100	0330	5,100	4230	9,100	6330
1,200	0310	5,200	4210	9,200	6310
1,300	0710	5,300	4610	9,300	6710
1,400	0730	5,400	4630	9,400	6730
1,500	0720	5,500	4620	9,500	6720
1,600	0760	5,600	4660	9,600	6760
1,700	0740	5,700	4640	9,700	6740
1,800	0540	5,800	4440	9,800	6540
1,900	0560	5,900	4460	9,900	6560
2,000	0520	6,000	4420	10,000	6520
2,100	0530	61,00	4430	10,100	6530
2,200	0510	6,200	4410	10,200	6510
2,300	0110	6,300	4010	10,300	6110
2,400	0130	6,400	4030	10,400	6130
2,500	0120	6,500	4020	10,500	6120
2,600	0160	6,600	4060	10,600	6160
2,700	0140	6,700	4040	10,700	6140
2,800	4140	6,800	6040	10,800	2140
2,900	4160	6,900	6060	10,900	2160

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C
C Altitude Reporting Code
Table 501 (Sheet 1)

R EFFECTIVITY: ALL
R
004B

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
11,000	2120	15,000	3020	19,000	7120
100	2130	100	3030	200	7130
200	2110	200	3010	200	7110
300	2610	300	3410	300	7510
400	2630	400	3430	400	7530
500	2620	500	3420	500	7520
600	2660	600	3460	600	7560
700	2640	700	3440	700	7540
800	2740	800	3640	800	7740
900	2760	900	3660	900	7760
12,000	2720	16,000	3620	20,000	7720
100	2730	100	3630	100	7730
200	2710	200	3610	200	7710
300	2310	300	3210	300	7310
400	2330	400	3230	400	7330
500	2320	500	3220	500	7320
600	2360	600	3260	600	7360
700	2340	700	3240	700	7340
800	2240	800	3340	800	7240
900	2260	900	3360	900	7260
13,000	2220	17,000	3320	21,000	7220
100	2230	100	3330	100	7230
200	2210	200	3310	200	7210
300	2610	300	3710	300	7610
400	2630	400	3730	400	7630
500	2620	500	3720	500	7620
600	2660	600	3760	600	7660
700	2640	700	3740	700	7640
800	2440	800	3540	800	7440
900	2460	900	3560	900	7460
14,000	2420	18,000	3520	22,000	7420
100	2430	100	3530	100	7430
200	2410	200	3510	200	7410
300	2010	300	3110	300	7010
400	2030	400	3130	400	7030
500	2020	500	3120	500	7020
600	2060	600	3160	600	7060
700	2040	700	3140	700	7040
800	3040	800	7140	800	5040
900	3060	900	7160	900	5060

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C
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Altitude Reporting Code
Table 501 (Sheet 2)

R
R
004B

EFFECTIVITY: ALL

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
23,000	5020	27,000	1120	31,000	1024
100	5030	100	1130	100	1034
200	5010	200	1110	200	1014
300	5410	300	1510	300	1414
400	5430	400	1530	400	1434
500	5420	500	1520	500	1424
600	5460	600	1560	600	1464
700	5440	700	1540	700	1444
800	5640	800	1740	800	1644
900	5660	900	1760	900	1664
24,000	5620	28,000	1720	32,000	1624
100	5630	100	1730	100	1634
200	5610	200	1710	200	1614
300	5210	300	1310	300	1214
400	5230	400	1330	400	1234
500	5220	500	1320	500	1224
600	5260	600	1360	600	1264
700	5240	700	1340	700	1244
800	5340	800	1240	800	1344
900	5360	900	1260	900	1364
25,000	5320	29,000	1220	33,000	1324
100	5330	100	1230	100	1334
200	5310	200	1210	200	1314
300	5710	300	1610	300	1714
400	5730	400	1630	400	1734
500	5720	500	1620	500	1724
600	5760	600	1660	600	1764
700	5740	700	1640	700	1744
800	5540	800	1440	800	1544
900	5560	900	1460	900	1564
26,000	5520	30,000	1420	34,000	1524
100	5530	100	1430	100	1534
200	5510	200	1410	200	1514
300	5110	300	1010	300	1114
400	5130	400	1030	400	1134
500	5120	500	1020	500	1124
600	5160	600	1060	600	1164
700	5140	700	1040	700	1144
800	1140	800	1044	800	5144
900	1160	900	1064	900	5164

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
35,000	5124	39,000	7024	43,000	3124
100	5134	100	7034	100	3134
200	5114	200	7014	200	3114
300	5514	300	7414	300	3514
400	5534	400	7434	400	3534
500	5524	500	7424	500	3524
600	5564	600	7464	600	3564
700	5544	700	7444	700	3544
800	5744	300	7044	800	3744
900	5764	900	7664	900	3764
36,000	5724	40,000	7624	44,000	3724
100	5734	100	7634	100	3734
200	5714	200	7614	200	3714
300	5314	300	7214	300	3314
400	5334	400	7234	400	3334
500	5324	500	7224	500	3324
600	5364	600	7264	600	3364
700	5344	700	7244	700	3344
800	5244	800	7344	800	3244
900	5284	900	7364	900	3284
37,000	5224	41,000	7324	45,000	3224
100	5234	100	7334	100	3234
200	5214	200	7314	200	3214
300	5614	300	7714	300	3614
400	5634	400	7734	400	3634
500	5624	500	7724	500	3624
600	5664	600	7764	600	3664
700	5644	700	7744	700	3644
800	5444	800	7644	800	3444
900	5464	900	7564	900	3464
38,000	5424	42,000	7524	46,000	3424
100	5434	100	7534	100	3434
200	5414	200	7514	200	3414
300	5014	300	7114	300	3014
400	5034	400	7134	400	3034
500	5024	500	7124	500	3024
600	5064	600	7164	600	3064
700	5044	700	7144	700	3044
800	7044	800	3144	800	2044
900	7064	900	3164	900	2064

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C
C

Altitude Reporting Code
Table 501 (Sheet 4)

R
R
004B

EFFECTIVITY: ALL

Altitude	Code ABCD	Altitude	Code ABCD	Altitude	Code ABCD
47,000	2024	51,000	6124	55,000	4024
100	2034	100	6134	100	4034
200	2014	200	6114	200	4014
300	2414	300	6514	300	4414
400	2434	400	6534	400	4434
500	2424	500	6524	500	4424
600	2464	600	6564	600	4464
700	2444	700	6544	700	4444
800	2844	800	6744	800	4644
900	2864	900	6764	900	4664
48,000	2824	52,000	6724	56,000	4624
100	2834	100	6734	100	4634
200	2814	200	6714	200	4614
300	2214	300	6314	300	4214
400	2234	400	6334	400	4234
500	2224	500	6324	500	4224
600	2264	600	6364	600	4264
700	2244	700	6344	700	4244
800	2344	800	6244	800	4344
900	2364	900	6264	900	4364
49,000	2324	53,000	6224	57,000	4324
100	2334	100	6234	100	4334
200	2314	200	6214	200	4314
300	2714	300	6614	300	4714
400	2734	400	6634	400	4734
500	2724	500	6624	500	4724
600	2764	600	6664	600	4764
700	2744	700	6644	700	4744
800	2544	800	6444	800	4544
900	2564	900	6464	900	4564
50,000	2524	54,000	6424	58,000	4524
100	2534	100	6434	100	4534
200	2514	200	6414	200	4514
300	2114	300	6014	300	4114
400	2134	400	6034	400	4134
500	2124	500	6024	500	4124
600	2164	600	6064	600	4164
700	2144	700	6044	700	4144
800	6144	800	4044	800	0144
900	6164	900	4064	900	0164
				59,000	0124

ATC TRANSPONDER - REMOVAL AND INSTALLATION

1. Reference Procedure

34-53-00 Air Traffic Control System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION - ATC (G3) or NO. 2 NAVIGATION - ATC (G21).

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate two ATC transponders on rear rack, shelf 1, (Ref. Fig. 401).

(3) Loosen and disengage knurled knobs securing ATC transponder to be removed from mount.

(4) Slide ATC transponder forward until rear connector is disengaged from mount connector. Remove ATC transponder.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Position ATC transponder on mount and slide into place, aligning rear connector and mount connector.

(3) Place mount clamps over ATC transponder hooks.

(4) Tighten knurled knobs securing ATC transponder to mount.

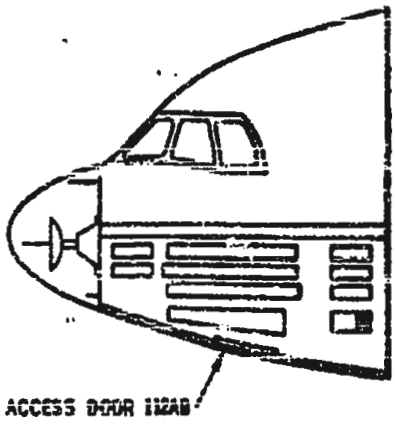
(5) Close and secure access door.

(6) Remove tag and close circuit breaker opened in Step A(1).

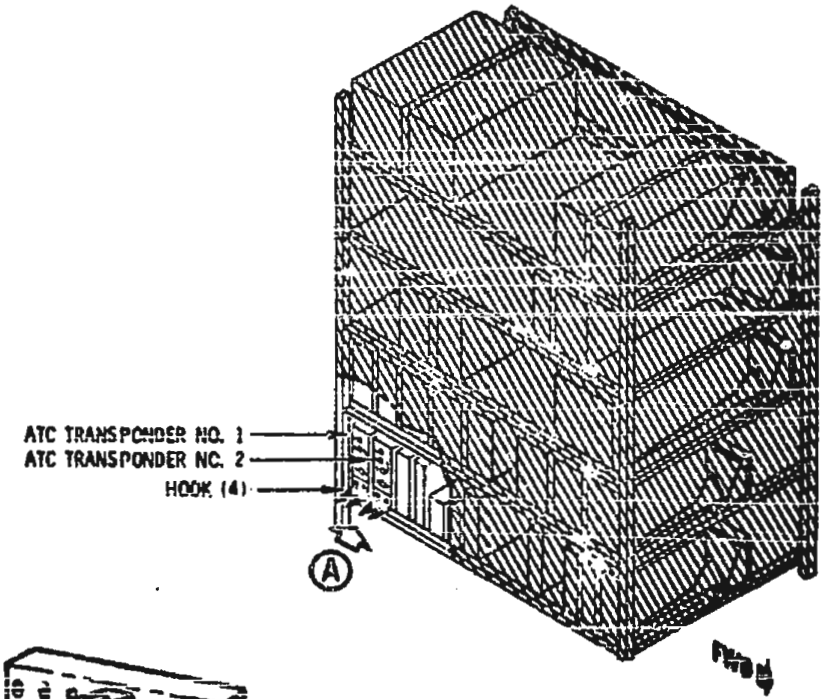
C 3. Test

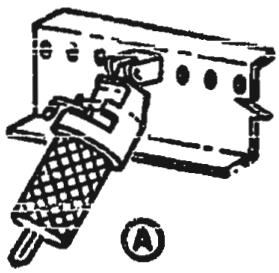
CR A. Test Equipment Required

CR (1) ATC Transponder Tester



FESC REAR RACK, SHELF NO. 1





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ATC Transponder - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

(a) Collins 476X Test Set; OR

(b) TEL Instruments T338 Test Set.

(2) Altitude Reporting Test Set 34-53-01-0053.

(a) If this test set not available, perform operational test 34-53-00, Page 501, Paragraph 1 using Pitot/Static tester.

B. Test System

(1) Check that circuit breaker for effected ATC is closed, and radio bus switches are on.

(2) Turn function selector switch on ATC control module to STBY for at least 1 minute, then position to ATC No. 1 or No. 2 as applicable.

(3) Set mode switch on ATC control module to mode A, and transponder selector switch to effected ATC.

(4) On ATC transponder, depress test button and check that the TEST light, on L-1011, or REPLY light on all other aircraft, illuminates. Release test button.

(5) Disconnect number 1 CADC from rack connectors and install 34-53-01-0053 Altitude Reporting Test Set connector into bottom rack connector. Set tester to 2,300 ft. position.

(6) At the ATC control module, select the Altitude Source Select switch to the number 1 position.

(7) Place ATC Transponder test set in a position such that test set antenna is in view of aircraft antennas.

NOTE: There must be no objects or personnel between the ramp test set and the aircraft ATC radar beacon antenna.

(a) Using Collins 476-3 Test Set

1) Prepare for Test

a) Set 476X-3 mode selector switch to A-B-C and verify that mode flags indicate A to B to C in sequence.

b) Set mode selector switch to self-test position. Set T/R ATTEN control to 25 DB. Observe that meter indicates to the right of

RECHARGE. If meter indicates to the left of RECHARGE, the battery must be recharged before tester is used.

c) Calibrate the R-F output by setting mode selector to SELF-TEST. Position calibrate output-battery voltage switch in CALIBRATE OUTPUT position, and adjust output to obtain a red-line indication or meter.

d) Self-test by setting mode selector switch to SELF-TEST, and setting T-R ATTEN control to 25 DB. Observe that IDENT FLAGS appear.

e) Set code selector to 0000. Observe that CODE and IDENT flags appear in steady state.

f) Set code 7777. Observe that CODE and IDENT flags appear in steady state.

g) Set code 7773. Observe that CODE flag blinks; IDENT flag appears in steady state.

h) Set code 0004. Observe that CODE flag blinks; IDENT flag appears in steady state.

i) Set mode selector switch to Mode C.

2) Set code 0110. Observe that code flag appears in steady state.

3) Position Altitude Reporting test set to each altitude test point listed below and check that code flag appears steady when the respective code is selected on ATC Transponder Tester.

Altitude	Code	Altitude	Code
2,300	0110	2,500	0120
3,800	4740	4,300	4510
4,800	4240	6,800	6040
14,800	3040	30,800	1044

(b) Using TEL Instruments T33B Test Set

1) Place MODE switch on tester to Mode C and readout switch to Altitude.

C 2) Position Altitude Reporting Tester to each
C altitude test point listed in (a)3) above.

C 3) With power switch held on readout window
C should indicate each altitude test point.

C (8) Disconnect Altitude Reporting Tester and reconnect CADC

C (9) Set both Captain's and First Officer's altimeters to
C 29.92.

C (10) Check that altitude readout when using the T33B Test
C Set matches the Captain's altimeter reading within ±125
C ft.

C (a) When using the 476-3 Test Set, the altitude code
C must be set into tester. The altitude code must
C match the Captain's altimeter reading within 125
C ft.

C (11) At ATC control module, select the Altitude Source
C Select switch to the number 2 position and repeat Step
C 10 using First Officer's altimeter readings.

C (12) Perform leak check on Captain's pitot/static systems if
C lines disconnected when Altitude Reporting tester is
C installed.

C (13) Secure ATC ramp tester.

C NOTE: An operational test WILL NOT SUFFICE when an altitude
C reporting malfunction is involved with the
C transponder being replaced. See verification of
C altitude reporting corrections per Paragraph 4 of
C this procedure.

C 4. Verification of Altitude Reporting Corrections

C A. If it is necessary to insure at least one transponder is
C operating normally in the Altitude reporting mode, then
C perform the following additional checks: (Ref. ATC
C Transponder Adjustment/Test 34-53-00 Pages 501 - 507E)

C NOTE: If Altitude Reporting is reported as INOP, perform
C Step A(1); if reported as ERRONEOUS, perform Step
C A(2).

C (1) Perform station elevation check per the following
C system test:

C (a) Paragraphs 2F(1) and (2)(i) thru (p) when using
C Packard Bell TS/004 Test Set.

C (b) Paragraphs 2C and D (6) thru (12) when using
C Collins 476X-3 Test Set.

C (c) Paragraphs 2C and E (17) thru (23) when using
C Tel-Instruments T33-B Test Set.

C (2) Perform either Step (a) or Step (b) below:

C (a) Resistance Check

C 1) A point to point resistance check of all 11
C wires between transponder and altitude source for
C open, shorts to ground or shorts between wires.

C (b) Encoder and Wiring Check

C 1) Equipment required:

C a) Pitot/Static Tester or altitude reporting
C tester, 34-53-01-0053

C b) ATC Transponder Tester

C NOTE: Refer to these equipment instructions, if
C required.

C 2) Check

C a) Set the applicable altimeter to 29.92.

C b) Select ATC No. 1 or No. 2 and ALT RPTG
C source No. 1 or No. 2 on the ATC control unit,
C as applicable.

C c) Connect the Pitot/Static tester or
C altitude reporting tester to the applicable
C system.

C NOTE: Check 30800 altitude only when problem is
C experienced at high altitude.

CR
CR
C
C

d) Adjust the Pitot/Static or altitude reporting tester until the ATC transponder tester indicates the following altitudes are being reported:

2300	2500	3800	4300
4800	6800	14800	30800

C
C
C
C
C
C

NOTE: As each altitude code segment on the encoder is 100 feet wide, the altimeter reading may be increased or decreased to see if ±125 feet tolerance can be met PROVIDED the transponder tester continues to read the designated altitude.

CR
C
C

e) If using Pitot/Static tester at each altitude, the applicable altimeter must indicate the designated altitude ±125 ft.

ATC TRANSPONDER SYSTEM CONTROL PANEL - REMOVAL AND INSTALLATION

1. Reference Procedure

34-53-00 ATC Transponder System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION ATC (G3) and NO. 2 NAVIGATION ATC (G21).

(2) Locate ATC transponder system control panel in pilots center console, zone 210, (Ref. Fig. 401).

(3) Loosen Dzus fasteners securing ATC Transponder control panel to pilots center console.

(4) Pull ATC Transponder control panel from recess in pilots center console and disconnect aircraft cable connectors from receptacles on control panel.

(5) Remove ATC Transponder control panel.

B. Installation

(1) Verify circuit breakers opened in Step A(1) are opened and tagged.

(2) Connect aircraft cable connectors to receptacles on rear of panel.

(3) Place ATC Transponder control panel in pilots center console recess.

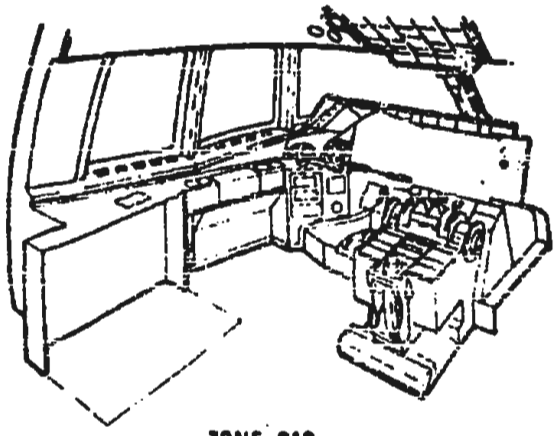
(4) Secure Dzus fasteners.

(5) Remove tag and close circuit breaker opened in Step A(1).

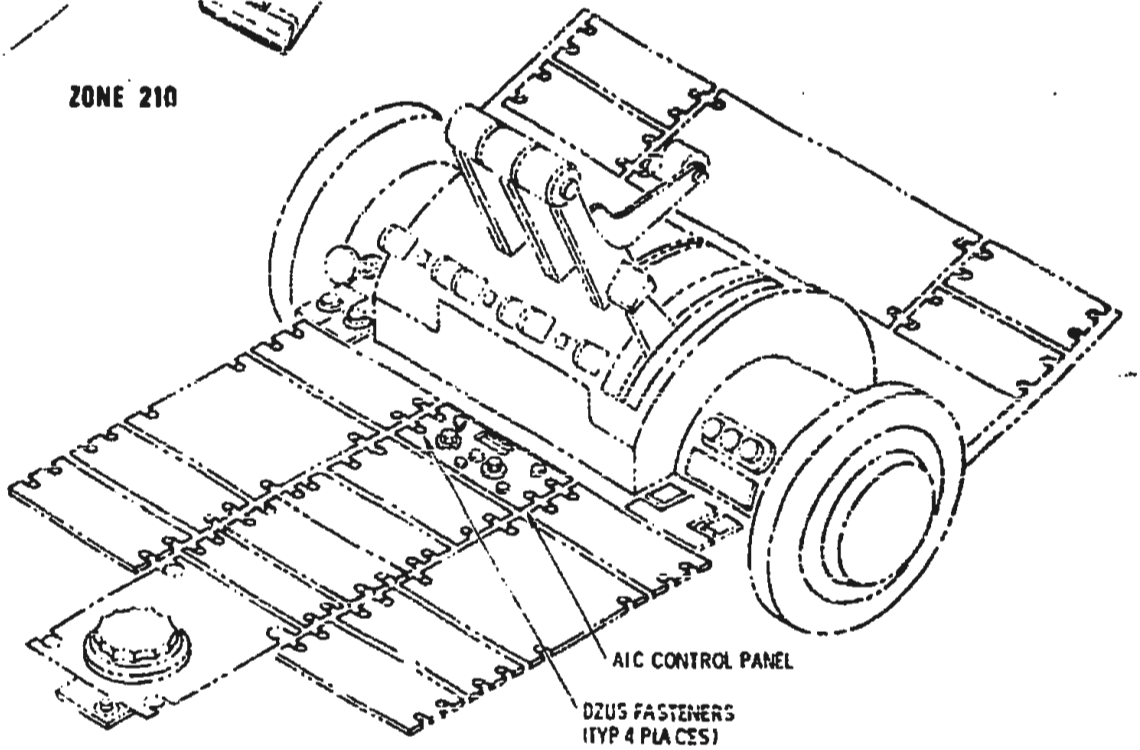
C (6) Perform ATC Transponder Control Panel Operational Test
C procedure, Para. 3 of this procedure.

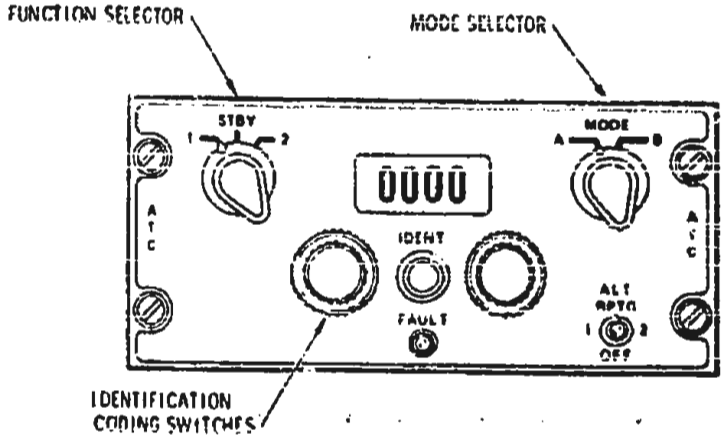
C 3. Operational Test - Control Panel

C A. Preparation for Test



ZONE 210





M1-0000-34-4513

CR Transponer Control Panel - Removal and Installation
CR Figure 401

C (1) On pilot's overhead circuit breaker panel CB-1, verify
C that the following circuit breakers are closed:

C NO. 1 NAVIGATION - ATC

C NO. 1 NAVIGATION - AIR DATA CMPTR

C NO. 1 INSTRUMENT - ALTM

C NO. 2 NAVIGATION - ATC

C NO. 2 NAVIGATION - AIR DATA CMPTR

C NO. 2 INSTRUMENT - ALTM

C B. General

C (1) The following paragraph provides a step-by-step
C operational test.

C (2) Equipment required:

C (a) ATC Transponder Tester.

C WARNING: DO NOT SELECT CODES 7777, 7700, 7600 or
C 7500 ON THE AIRCRAFT ATC CONTROL UNIT.
C THEY ARE FOR CERTAIN EMERGENCY CODES.

C C. Test System

C (1) Provide electrical power.

C (2) Turn function selector switch on ATC control module to
C STBY and allow at least 1 minute warm-up time.

CR (3) Set function selector to No. 1 position.

CR (4) Set mode switch on ATC control module to mode A.

CR (5) Perform Altitude Reporting Test, Para. 3.D. or 3.E.

C D. Operational Test - ATC System - Using Collins 476X-3 Test
C Set

C (1) Prepare for Test

C (a) Set 476X-3 mode selector switch to A-B-C and
C verify that mode flags indicate A to B to C in
C sequence.

C (b) Set mode selector switch to self-test position.
C Set T/R ATTEN control to 25 DB. Observe that

C meter indicates to the right of RECHARGE. If
C meter indicates to the left of RECHARGE, the
C battery must be recharged before tester is used.

C (c) Calibrate the R-F output by setting mode selector
C to SELF-TEST. Position calibrate output-battery
C voltage switch in CALIBRATE OUTPUT position, and
C adjust output to obtain a red-line indication on
C meter.

C (d) Self-test by setting mode selector switch to
C SELF-TEST, and setting T-R ATTEN control to 25 DB.
C Observe that IDENT FLAGS appear.

C (e) Set code selector to 0000. Observe that CODE and
C IDENT flags appear in steady state.

C (f) Set code 7777. Observe that CODE and IDENT flags
C appear in steady state.

C (g) Set code 7773. Observe that CODE flag blinks;
C IDENT flag appears in steady state.

C (h) Set code 0004. Observe that CODE flag blinks;
C IDENT flag appears in steady state.

C (i) Place test set in a position such that test set
C antenna is in view of aircraft antennas

C NOTE: There must be no objects or personnel
C between the ramp test set and the aircraft
C ATC radar beacon antenna.

C (j) With electrical power on the aircraft and both
C radio bus switches closed, check that circuit
C breakers for both ATC systems and both air data
C instrumentation systems are activated.

C (k) Set both altimeters in the aircraft to 29.92 and
C read the indicated altitude. Using Altitude
C Reporting Code, Fig. 501, (Ref. 34-53-00 ATC
C System Adjustment/Test) determine the nearest 4
C digit altitude code for the altitude read on the
C altimeters. Select this code on the test set.

C EXAMPLE: Aircraft altimeter reads 800 feet
C when set to 29.92. Altitude code
C from Altitude Reporting Code,
C Fig. 501 (Ref. 34-53-00 ATC System
C Adjustment/Test) for 800 feet is 0340.
C This 4-digit altitude code should
C be selected on test set.

NOTE: If, in the example above, the 1000' drum indicates below zero, the altitude is -200 and the code is 0640.

(1) Position the switches on the aircraft ATC control panel as follows:

1) Function switch - No. 1

2) Mode Selector Switch - Mode A

3) Alt Rptg Source - OFF

(m) Place the mode switch on the test set to MODE C position and the Alt Rptg Source switch on the ATC control panel to the No. 1 position. A steady code flag should appear on the test set indicating the altitude reporting function is functioning.

NOTE: If a steady CODE flag does not appear, re-test with the test set and control panel code switches set to the next higher and the the next lower altitude code (next 100 feet increment above and below altimeter reading), as indicated in the Altitude Reporting Code, Fig. 501 (Ref. 34-53-00 ATC System Adjustment/Test). If a steady CODE is not indicated in one of the three tests, the altitude reporting function is malfunctioning.

(n) Repeat step (m) with the Alt Rptg Source switch on the aircraft ATC control panel placed in the No. 2 position.

(o) Return the Alt Rptg Source switch to the No. 1 position, place the function selector switch on the aircraft ATC control panel to the No. 2 position.

(p) Test the No. 2 ATC system as outlined in Steps (m) through (n).

(q) Turn the ramp test unit mode selector switch to the OFF position.

(r) Turn OFF the radio bus switches on the aircraft.

(s) Determine whether there is further need for external power on the aircraft and if not, remove the external power.

E. Operational Test - ATC System - Using TEL-Instruments T33B Test Set

(1) Prepare for Test

(a) Place test set in a position such that test set antenna is in view of aircraft antennas

NOTE: There must be no objects or personnel between the ramp test set and the aircraft ATC radar beacon antenna.

(b) With electrical power on the aircraft and both radio bus switches closed, check that circuit breakers for both ATC systems and both air data instrumentation systems are activated.

(c) Set both altimeters in the aircraft to 29.92 and record the indicated altitude for use in following tests.

(d) Position the switches on the aircraft ATC control panel as follows:

1) Function switch - No. 1

2) Mode Selector Switch - Mode A

3) Alt Rptg Source - OFF

(e) Place the MODE switch on the test set to mode C, place READOUT switch to ALTITUDE and place the ALT RPTG source switch on the ATC control panel to the No. 1 position. Hold POWER switch ON. The readout windows should indicate the field elevation as indicated by the altimeters ± 75 feet. The READOUT switch may be changed to the PILOTS position and the test set will indicate the altitude transmission code for the indicated altitude.

NOTE: (1) The READOUT selector may be placed in the BINARY position and will indicate the actual number of A-B-C-D pulses transmitted. The tester will add 400,000 feet to altitude if any invalid C pulses are present (C0 -C5 -C7), 200,000 feet if any invalid D pulses are present (D1 -D3 -D5 -D7), and 600,000 feet if both erroneous C and D bits are present.

C NOTE: (2) When there is no Mode C information, such as would occur with a disconnected digitizer, the T-33B altitude readout will be 4007. This can be verified by setting the T-33B readout switch to PILOT. A display of 0000 will be indicated.

C (f) Repeat step (e) with the ALT RPTG source switch on the ATC control panel placed in the No. 2 position.

C (g) On ATC control panel, place ALT RPTG source switch
CR OFF, function selector switch to No. 2 position.

C (h) Test the No. 2 ATC system as outlined in steps (e) through (f).

C (i) Secure ramp test equipment.

C (j) Turn OFF the radio bus switches on the aircraft.

C (k) Determine whether there is further need for external power on the aircraft and if not, remove the external power.

ATC SYSTEM ANTENNA - REMOVAL AND INSTALLATION

1. Reference Procedures

34-53-00 ATC System - Adjustment and Test

20-51-04 Environmental Sealing

2. Equipment and Materials

Soft clean cloths

Gloves, disposable, MIL-G-36281 or equivalent

Plastic scraper

Solvent, Methyl-Ethyl-Keytone (MEK), Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279), Mfr. P.N PR1436G-B2, TW Stk Nbr 50-1188)

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 1 NAVIGATION - ATC (G3) if removing ATC antenna No. 1, or No. 2 NAVIGATION - ATC (G21) if removing ATC antenna No. 2.

(2) R Locate ATC antenna at bottom centerline of aircraft, zone 124, No. 1 at FS 565 or No. 2 at FS 605 (Ref. Fig. 401).

(3) Remove bolts securing ATC antenna to bottom of fuselage.

(4) Lower antenna sufficiently to disconnect antenna connector. Remove antenna and packing.

R WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

KEEP MEK AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

(5) Using plastic scraper, remove sealant from fuselage
R structure. Using soft clean cloth moistened with
R methyl-ethyl-keytone solvent, wipe fuselage structure clean.

B. Installation

R (1) Verify circuit breaker opened in Step 2A(1) is open and tagged.

R WARNING: USE TRICHLOROETHANE IN WELL VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH
R SKIN. PROLONGED EXPOSURE MAY RESULT IN
R UNCONSCIOUSNESS, LUNG OR SKIN IRRITATION.

(2) Using clean soft cloth moistened with trichloroethane solvent, clean faying surfaces of fuselage skin and antenna mounting plate. Before solvent dries, wipe dry with clean cloth.

CR (3) Spray fuselage and antenna mating surfaces with LPS-3
CR corrosion inhibitor. Replace packing.

CR (4) Start coaxial connector threads, spray remaining
CR threads with LPS-3 then secure connector.

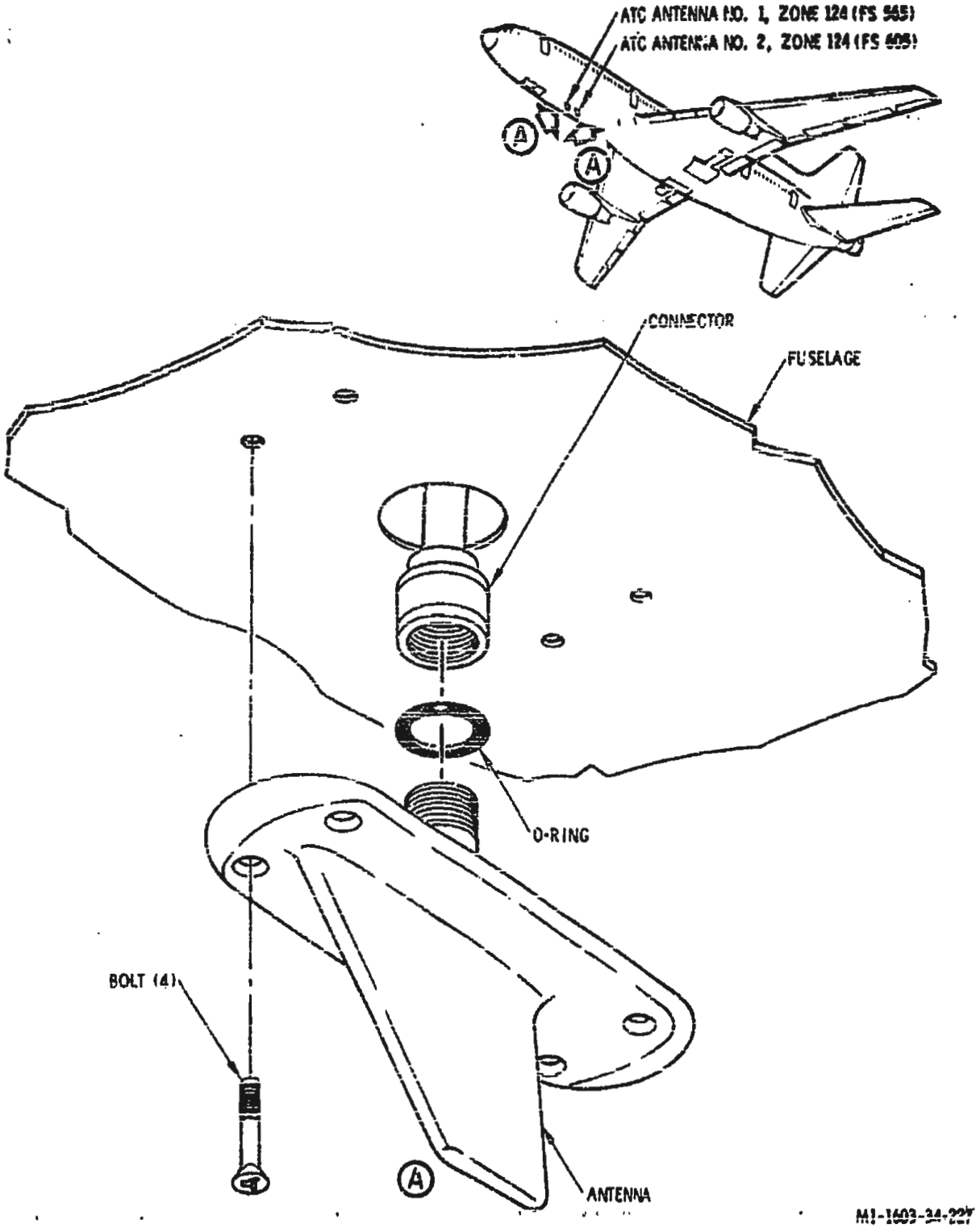
(5) Position antenna, aligning mounting holes on antenna and fuselage.

(6) Install and tighten bolts securing antenna.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(7) Wearing gloves, apply a continuous sealant fillet between antenna plate and fuselage using Environmental Sealant, LAC Spec C-40-1279 or equivalent (Ref. 20-51-04).

(8) Remove tag and close circuit breaker opened in Step 2A(1).



R ATC Transponder System Antenna - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

R R (9) Perform ATC system adjustment and test procedure (Ref. 34-53-00).

VOR SYSTEM - DESCRIPTION AND OPERATION

1. General

There are two independent VOR (very-high-frequency omnidirectional ranging) systems installed in the aircraft (Ref. Fig. 1). Each system consists of a VHF NAV control panel, a VOR (VHF NAV) receiver, a VOR preamplifier, a horizontal situation indicator (HSI), and a common VHF NAV accessory unit and VHF NAV antenna and feed assembly shared by both systems.

Each VOR system provides the following information:

VOR station audio identification signal to the audio distribution unit (Ref. 23-51-00).

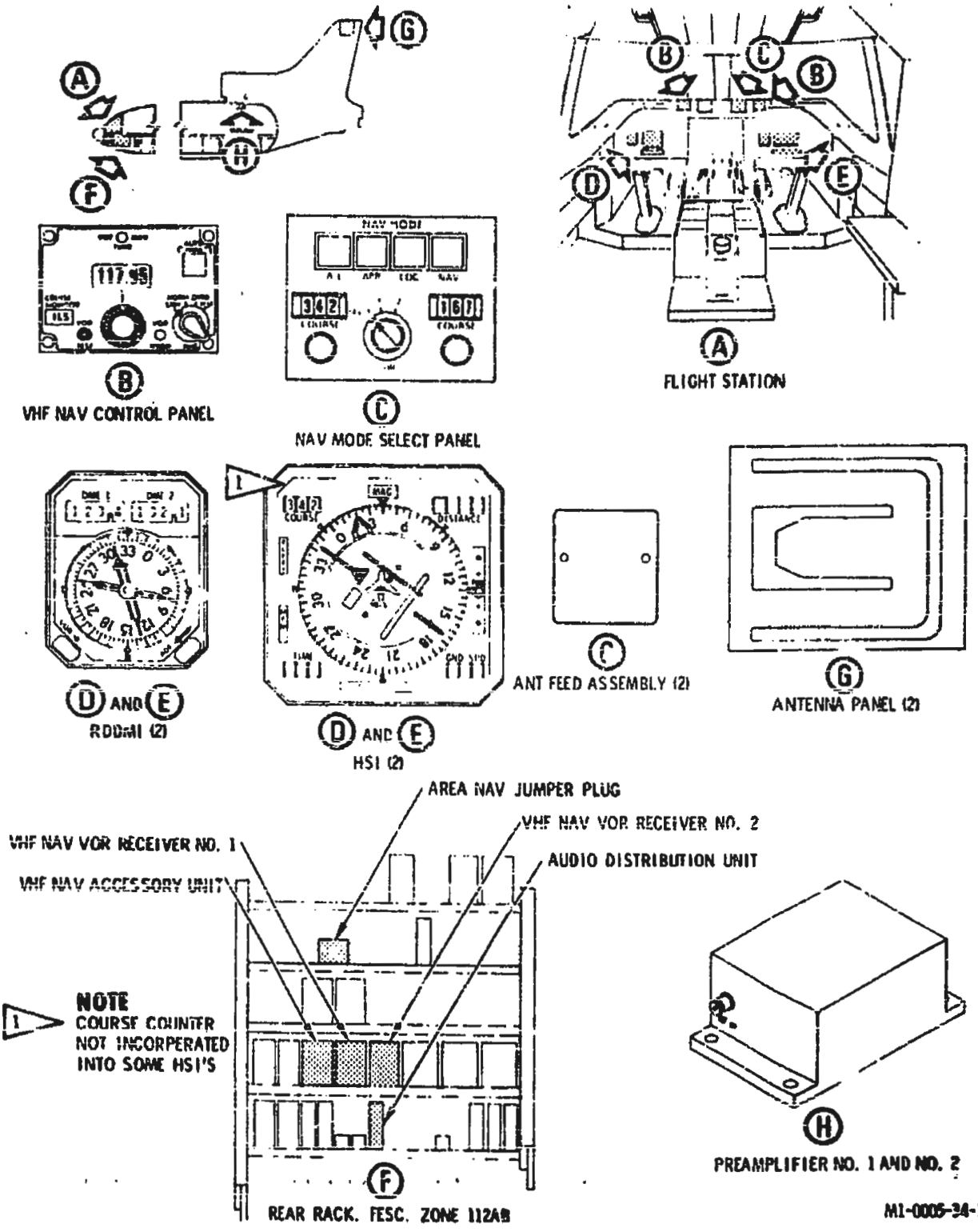
VOR bearing signal and warning flag signal to the radio digital distance magnetic indicator (RDDMI) (Ref. 34-57-00).

To-from (station heading) information, VOR deviation (right-left), and warning flag signals to the HSI and the roll computers (Ref. 22-13-00).

2. Operation

The VOR system is a navigation aid that enables the flight crew to determine the aircraft bearing and azimuth, relative to a VOR ground station. The operator selects a VOR ground station by adjusting the frequency selector knob on the Captains or First Officers VHF NAV control panel. The selected frequency is displayed on the VHF NAV control panel frequency indicator. Frequency select wires from the VHF NAV control panels provide an interface to the VOR receivers. The interface consists of 13 frequency select wires. The frequency is selected by a 2-out-of-5 binary wire code. This 2-out-of-5 binary code selects and tunes the receiver input circuits.

R The principle of VOR navigation is a phase comparison of two
R 30-Hz audio signals transmitted from the VOR ground station.
The phase difference is directly related to bearing. One audio
R signal, the reference 30-Hz signal, is transmitted on a 9960-Hz
R subcarrier. The subcarrier is frequency modulated between
R 10,440-Hz and 9480-Hz at a rate of 30-Hz. The other audio
R signal, the variable 30-Hz signal, is transmitted as amplitude
R modulation of the RF carrier. The variable 30-Hz signal is
obtained by transferring the RF carrier to a dipole antenna and
R rotating the antenna at a rate of 30-revolutions per second.
R The field strength pattern is a cardioid configuration (heart
R shaped) that is rotated through 360-degrees of azimuth at a rate



CR
CR

VHF Navigation (VOR) System
Figure 1

R of 1800-revolutions per minute. The phase of the variable 30-Hz
R signal with respect to that of the reference 30-Hz signal, varies directly with the azimuth of the receiver from the antenna. The phase displacement at any point in azimuth designates the bearing at that point. The difference in phase is measured by the VOR system in the aircraft. The phase difference is used by the VOR system to provide outputs to the HSI, RDDMI, and the roll computers (Ref. 22-13-00). In normal operation, VHF NAV (VOR) receiver No. 1 supplies output signals to the Captains HSI, and VHF NAV (VOR) receiver No. 2 supplies output signals to the First Officers HSI. If the Captain presses the ALTN DEV switchlight on the Captains INSTRUMENT
R SOURCE SELECT panel (Ref. 34-00-01), relays are energized in the VHF NAV accessory unit. Through relay contacts, signals from VHF NAV (VOR) receiver No. 2 are displayed on both HSIs. When the First Officer presses the ALTN DEV switchlight on the First Officers INSTRUMENT SOURCE SELECT panel, relays are energized in the VHF NAV accessory unit. Through relay contacts, signals from VHF NAV (VOR) receiver No. 1 are displayed on both HSIs (Ref. Fig. 2).

Power is applied to the VOR system through the following circuit breakers located on the pilots overhead circuit breaker panel CB1, zone 210:

Circuit breakers No. 2 NAVIGATION-VHF DC-VOR RCVR and PREAMP, supply 28V dc from the dc standby bus to VHF NAV (VOR) receiver No. 1, the VHF NAV accessory unit, and to antenna preamplifier No. 1.

Circuit breaker 26 VAC NAV EXCITATION VOR-1, supplies 26V ac from instrument transformer No. 1 to VHF NAV (VOR) receiver No. 1. Circuit breaker 26VAC NAV EXCITATION RDDMI NO. 1, supplies 26V ac from instrument transformer No. 2 to the Captains and First Officers RDDMI.

Circuit breakers No. 2 NAVIGATION-VHF DC-VOR RCVR and PREAMP, supply 28V dc from the No. 2 dc bus to VHF NAV (VOR) receiver No. 2, the VHF NAV accessory unit, and to antenna preamplifier No. 2.

Circuit breakers 26 VAC NAV EXCITATION VOR-2 and RDDMI-2, supply 26V ac from instrument transformer No. 3 to VHF NAV (VOR) receiver No. 2 and to the Captains and First Officers RDDMI.

A. VHF NAV (DUAL VOR) Antenna System

The VHF NAV (dual VOR) antenna, 2 panels located at the top of the vertical stabilizer, receives variable and reference phase signals from VOR ground stations operating between 106
R and 118-MHz. VOR signals received by the antenna are fed to

the feed assembly which provides two outputs, one for each VOR preamplifier, through connecting coax cables to the VOR preamplifiers, located above the aft cabin.

B. VOR Preamplifier (Dual)

The VOR preamplifiers (preamps) receive inputs from the VHF NAV (dual VOR) antenna feed assembly. Preamp No. 1 and preamp No. 2 are connected to the VHF NAV antenna feed
R assembly by coaxial cables, 45-feet in length. The preamps amplify the VOR input signals. The preamp outputs are applied to the VOR receiver inputs through coaxial cables.

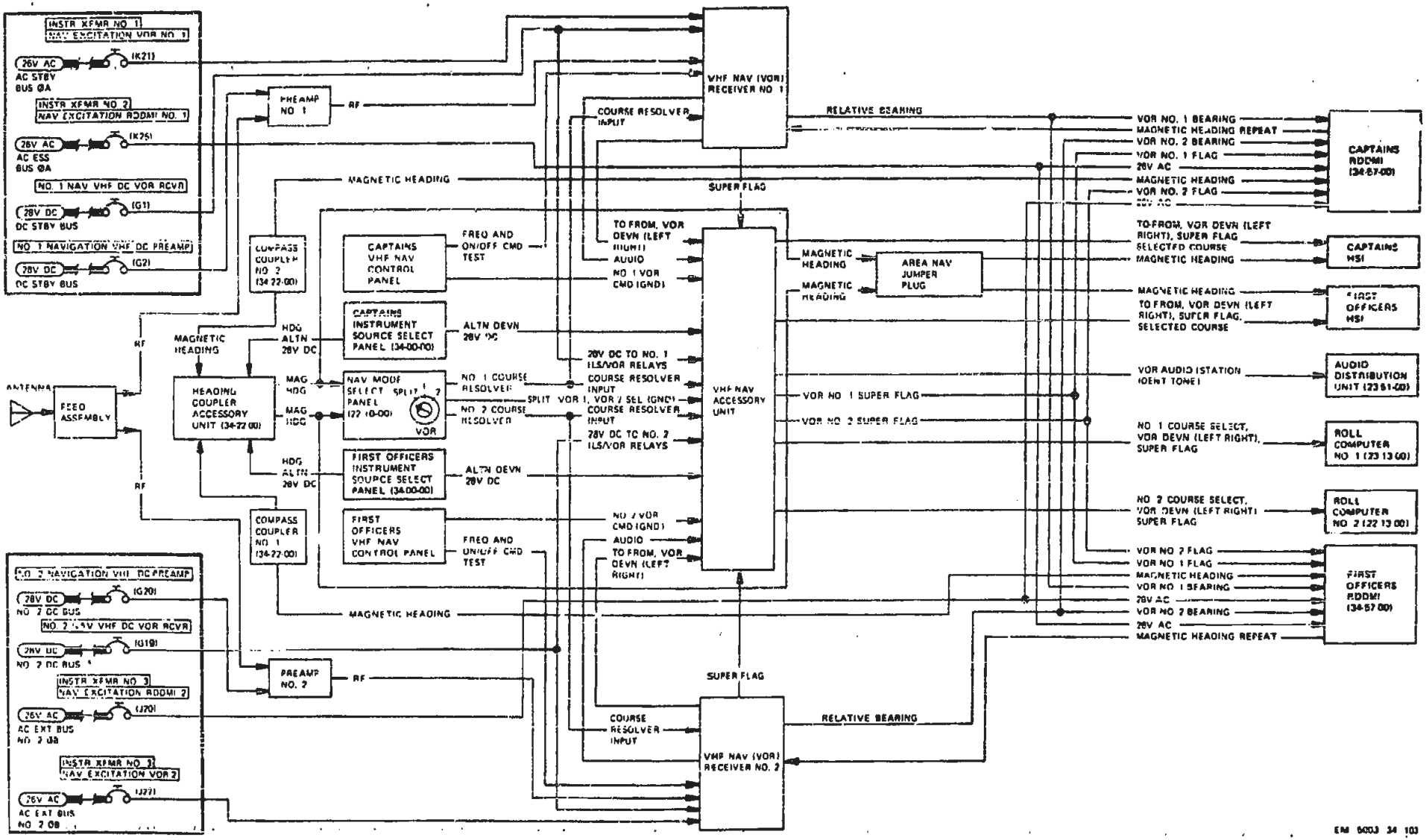
A coaxial cable and a T-connector are stowed behind the VOR receivers in the FESC (Ref. Fig. 108). The coaxial cable and T-connector allow operation of both VOR receivers from a single coaxial cable and preamp for fault isolation and dispatch purposes.

C. VHF NAV Control Panel

Two VHF NAV control panels are installed in the aircraft. One control panel is located on the Captains glareshield panel, and the other is located on the First Officers glareshield panel. The operation of each panel is identical. The frequency selector knob is used to select a
R frequency in the range of 108.00 to 117.95-MHz. The selected frequency is displayed on the frequency indicator. The frequency selector knob provides a selector control logic 2-out-of-5 binary wire code which corresponds to the selected frequency. The 2-out-of-5 binary wire code tunes the RF input circuits in the VOR receivers. The input circuits are tuned to the frequency selected by the frequency selector knob.

D. VOR (VHF NAV) Receiver

The VOR (VHF NAV) receiver consists of an input and detector section, a manual instrumentation unit, and an automatic instrumentation unit. The input and detector section receives the VOR RF carrier and detects audio frequencies of
R 30 and 9960-Hz. These audio frequency outputs are processed in the instrumentation units to provide VOR left-right deviation signals, flag outputs, to-from outputs, a VOR relative bearing output, a sin/cos output, and an aural output. The left-right deviation, to-from, and superflag signals are supplied to the HSI through relay contacts in the VHF NAV accessory unit. VOR relative bearing and superflag are supplied directly to the RDDMI. The aural output is supplied through a relay contact in the VHF NAV accessory unit to the audio distribution unit (Ref.



R VHF Navigation (VOR) System Block Diagram
R Figure 2

EFFECTIVITY: ALL

2768

23-51-00). The sin/cos output is used if area navigation (R-NAV) is installed.

E. VHF NAV Accessory Unit

The VHF NAV accessory unit contains external connectors and internal relays which interconnect the VOR receivers, the AFCS, and the instruments (HSI and RDDMI). When a VOR frequency is selected by the frequency selector on the VHF NAV control panel, a command ground is supplied to energize the VOR/ILS relays in the VHF NAV accessory unit. When the relays energize, contacts close to interconnect the VOR receivers, the AFCS, and the aircraft instruments.

F. Horizontal Situation Indicator (HSI)

Two HSIs are installed in the aircraft. One is located on the Captains instrument panel, the other is located on the
R First Officers instrument panel. When the Captains
R RADIO/INS switchlight on the center console is set to RADIO;
R the Captains HSI receives to-from, VOR deviation
R (left-right) information, and a warning (NAV) data valid
R signal from VOR receiver No. 1. A selected course signal is
R also received from the NAV MODE select panel (Ref.
R 22-10-00). The Captains HSI also receives magnetic heading
R information and a valid signal from compass coupler No. 1.

R When the Captains RADIO/INS switchlight is set to INS; the
R VOR deviation inputs to both HSIs are replaced with the
R XTK-DEV (cross track deviation) signal from inertial
R navigation unit No. 1 (INU (Ref. 34-43-00), the course
R select signals to both HSIs from the NAV MODE select panel
R are replaced with the TKE+DA (desired track + drift angle)
R signal from the INU, and the NAV (data valid) flag. To-from
R signals, ALERT and MEMORY lights are controlled by the INU.
R The INU also supplies distance, time to go, and ground speed
R information to the HSI digital readouts.

R When the F/Os RADIO/INS switchlight is set to RADIO or INS,
R the inputs are supplied by VOR No. 2, compass coupler No. 2
R or INU No. 2. The to-from information from the VOR
R receivers, or the INU, operate a zero-center meter movement
R in the HSI which drives the to-from pointer into view. The
R pointer points to the course arrow point if the aircraft is
R flying the selected course to the station or waypoint. The
R pointer points to the course tail if the aircraft is flying
R the selected course from the station, or has overflown the
R last waypoint. The to-from pointer will be masked from view
R if a valid VOR or INS input signal is lost, or if the
R aircraft is directly over the selected VOR station. The VOR
R deviation (left-right) information from the VOR receivers
R and the XTK-DEV signal from the INU operate a zero-center

meter movement which displaces the course deviation bar in the HSI from zero in proportion to the discrepancy between the selected course or desired track + drift angle, and the course or route being flown. With a zero-deviation input signal, the course deviation bar lines up with the course arrow. When either pilot selects a course by operating the course control knob on the NAV MODE select panel in RADIO mode, or the INU generates a TKE+DA signal in INS, a differential transmitter rotor is turned. This differential transmitter rotor is coupled to a servo in the HSI which turns the HSI course arrow.

VOR Receiver

A. Description

There are two identical VOR receivers in the VOR system. Each receiver is a solid-state, 180 channel receiver. The VOR receiver consists of:

An input and detector section

A manual instrumentation unit

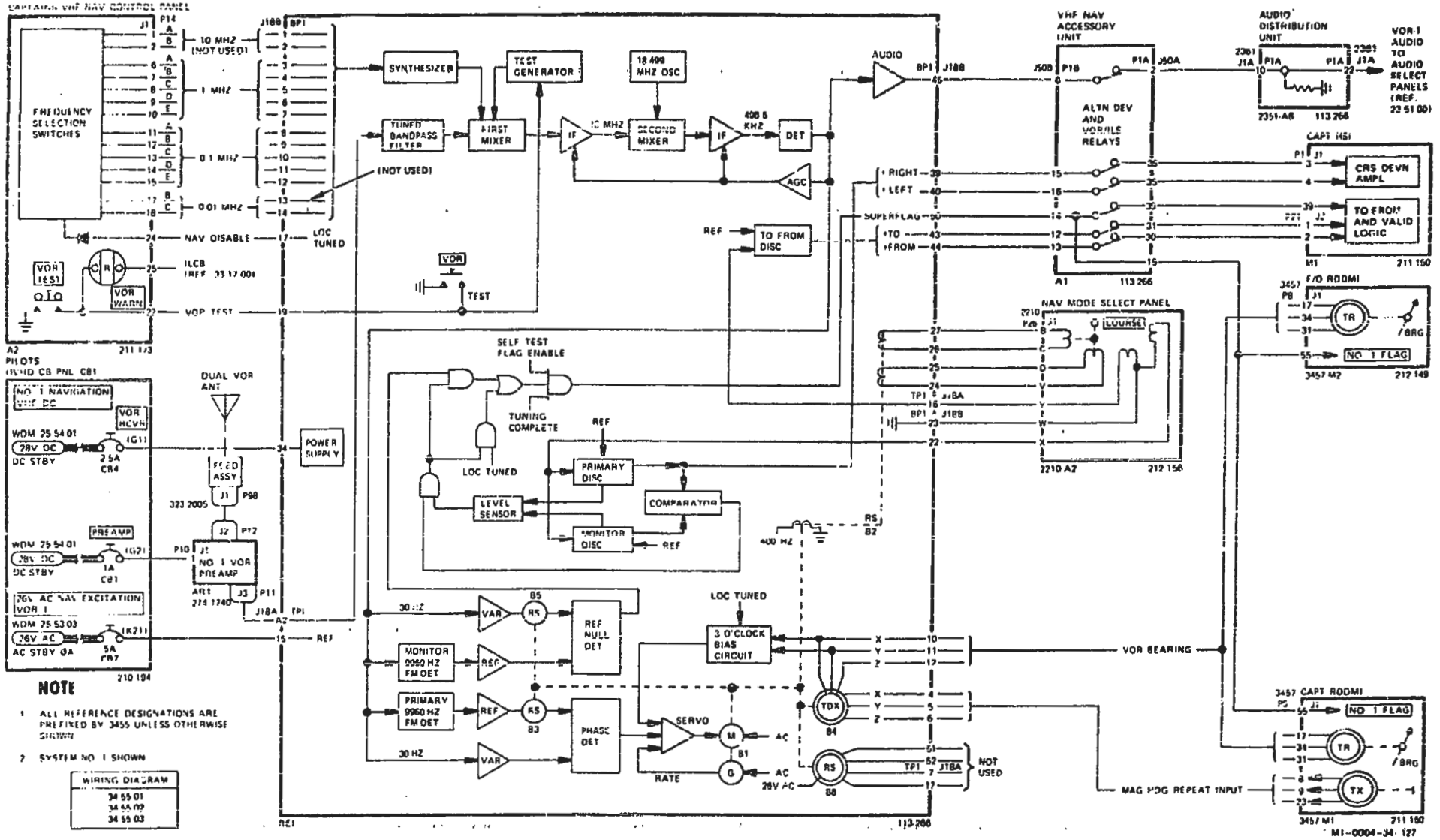
An automatic (primary) instrumentation unit including a monitor channel

A manual instrumentation unit including a monitor channel

The input and detector section contains a frequency synthesizer, an oscillator, RF amplifier input and output circuits, and the necessary filter and detector circuits. The automatic instrumentation unit contains detection circuits, amplifier circuits for the 30-Hz reference and 30-Hz variable signals, phase-detector circuits, resolvers, a motor-generator, and a differential synchro. The manual instrumentation unit contains primary and secondary deviation discriminators and a to-from discriminator.

B. Operation

The VOR receivers are tuned to the VOR frequency selected by the frequency knob on the VHF NAV control panel. The 2-out-of-5 selector control from the VHF NAV control panel is applied to the frequency synthesizer which incorporates circuits to convert this information to binary coded decimal (bcd) information to tune the selected frequency (Ref. Fig. 3). The 108.00 to 117.95-MHz RF signals from the VOR ground station are applied to the VOR receivers from the preamps.



NOTE

1. ALL REFERENCE DESIGNATIONS ARE PREFIXED BY 3455 UNLESS OTHERWISE SHOWN
2. SYSTEM NO. 1 SHOWN

WIRING DIAGRAM
34 55 01
34 55 02
34 55 03

R VHF NAV (VOR) Receiver Simplified Schematic
R Figure 3

EFFECTIVITY: ALL

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The RF signals are coupled through tuned filter circuits to the RF amplifier. The output is applied to the first mixer where it is mixed with the injection frequency from the frequency synthesizer. The 18.0-MHz output is coupled to the second mixer where it is mixed with the local oscillator. The resulting 498.5-KHz output is amplified through three IF stages and detected. The detected audio is supplied through isolation stages to the AGC circuits, audio amplifier, and the instrumentation circuit. The VOR receiver audio output is applied to the aircraft audio distribution system to enable the pilots to hear VOR voice information. The NAV disable signal disables the receiver when it is tuned to a frequency other than a NAV frequency.

(1) Automatic (Primary) Instrumentation Unit

The VOR outputs from the receiver are applied to a monitor and primary 9960-Hz FM amplifier and detector, and the variable 30-Hz amplifier circuits. The 9960-Hz detector circuit demodulates the 30-Hz reference signal from the 9960-Hz subcarrier. The 30-Hz reference signal is amplified and applied to the primary resolver B3 and phase detector. The variable 30-Hz signal is also applied to the phase detector. When the two signals, reference and variable 30-Hz, are 90-degrees out of phase, the phase detector output will be zero. When the two signals are more, or less, than 90-degrees out of phase, this output is applied to the servo amplifier and drives motor-generator B1. The motor turns the rotors of resolvers B3 and B5, thus shifting the phase of the reference 30-Hz signal. Motor-generator B1 continues to turn until the signal from the phase detector is 90-degrees out of phase. The motor-generator also drives differential synchro B4 and resolver B2. Differential synchro B4, supplies VOR bearing information to the RDDMI. Resolver B2 supplies bearing information to the selected course resolver in the NAV MODE select panel. Resolver B6 supplies sin/cos bearing information to the area navigation (R-NAV) system if installed. The VOR monitor channel is identical to the primary channel. The 30-Hz reference and variable channels must be 90-degrees out of phase. This channel functions only as a monitor of the primary channel. If the primary channel fails, the monitor channel detects this and disables the superflag output.

(2) Manual Instrumentation Unit

When the pilot selects a course on the NAV MODE select panel that differs from the VOR bearing, a voltage will be induced into the primary and monitor discriminators.

The output will be a left or right deviation signal which is supplied to the course deviation bar in the HSI. The to-from discriminator circuit detects whether
R the VOR station direction is within 90-degrees of the selected radial, if so, a "to" output to the HSI will cause display of the appropriate indication. The "from" indication will display if the station direction
R is within 90-degrees of the reciprocal of the selected radial. The monitor channel does not provide a deviation output, it functions to monitor the operation of the primary channel. If either channel fails, the superflag voltage will be lost causing a NAV flag to appear in the HSI.

4. VHF NAV Control Panel

A. Description

Two VHF NAV control panels are provided to select input frequencies for the VHF NAV (VOR) receivers, the distance measuring equipment (DME) interrogators (Ref. 34-51-00), and the instrument landing system (ILS) receivers (Ref. 34-33-00). The VHF NAV control panels are mounted on the Captains and First Officers glareshield panels, zones 211 and 212. The VHF NAV control panels contain four 5V ac panel lights and four 5V ac dial lights for nighttime illumination. The following controls are provided on the control panel:

A four-position DME selector switch placarded STBY, NORM, OVRD, and TEST

A VOR TEST switch, an AUTO/MNL switch, and a VHF NAV TUNE lamp

A frequency selector knob which selects VOR, DME, localizer and glideslope frequencies

The selected frequency is displayed on a frequency indicator located directly above the frequency selector knob. Only the VOR-LOC frequencies are displayed. The DME frequencies are paired with the VOR frequencies and are automatically selected with the VOR frequencies. When a localizer frequency is selected, the paired glideslope frequency (UHF) is automatically selected.

Two connectors, J1 and J2, are mounted on the rear of the VHF NAV control panel. Connector J1 interconnects the VHF NAV control panel with the VOR receiver and the DME interrogator. Connector J2 interconnects the VHF NAV control panel with the ILS receiver.

(1) DME Mode Selector Switch

The DME mode selector switch is used to select the following modes of operation:

(a) STBY

The STBY (standby) mode inhibits the DME interrogator transmitter, but the interrogator-receiver remains operative.

(b) NORM

The NORM (normal) mode enables normal operation of the DME interrogator.

(c) OVRD

R The OVRD (override) mode enables the range gate within the DME interrogator- receiver circuits to search for a reply pulse out to 390-nautical miles.

(d) TEST

R The TEST mode enables a test circuit in the DME interrogator to cause a 0-nautical mile simulated range signal to be generated. The signal causes a readout of 000.0 (±0.1) on the DME-1 and DME-2 indicators on the RDDMI. This readout is preceded by a crosshatched shutter and 4 dashes for one second each.

(2) Frequency Selector Knob

The frequency selector knob is used to tune either the ILS receiver or the VOR receiver, and the DME interrogator to the desired frequency and channel. The selected VOR or localizer frequency is displayed on the frequency indicator.

NOTE: The AUTO/MNL switch and VHF NAV TUNE light are not operable unless an Area Navigation system is installed.

B. Operation

The frequency selector on the VHF NAV control panel provides a selector control logic 2-out-of-5 binary wire code which corresponds to the frequency selected (Ref. Fig. 4). This 2-out-of-5 binary wire code is used to tune the RF input circuits in the VOR receivers, the DME interrogators, and

the ILS receivers (Ref. Fig. 4). When a frequency within the VOR range is selected, the 2-out-of-5 binary wire code tunes the RF input circuits in the VOR receivers and the DME interrogators (if the DME selector is in NORM) to the selected frequency. The Captains VHF NAV control panel tunes VHF NAV (VOR) receiver No. 1 and DME interrogator No. 1. The First Officers VHF NAV control panel tunes VHF NAV (VOR) receiver No. 2 and DME interrogator No. 2. When a VOR frequency is selected, a CMD GND (command ground) signal is applied to the VOR relay coils in the VHF NAV accessory unit. When the frequency selector is tuned to an ILS frequency, the command ground signal is removed and the VOR/ILS relay coils are deenergized (Ref. Fig. 4). The VHF NAV system is fail-safe to ILS. The VOR frequency range is from 108.00 to 112.00-MHz in even tenths and from 112.00 to 117.95-MHz in both odd and even tenths. The localizer frequency range is 108.00 to 111.95-MHz in odd tenths.

5. VOR Preamplifier (Dual)

A. Description and Operation

Two preamplifiers (preamps) are provided in the VOR system. Each preamp interconnects the dual VHF NAV antenna and feed assembly to a VOR receiver. The preamps are located in the area above the ceiling of the right-hand-aft passenger compartment, zone 274. Two connectors are located at the front of the preamp and one connector is located on the rear of the preamp. The preamp is six inches long, two inches wide, two inches high and weighs one pound. The preamp is a solid-state, silicon unit with an integral bandpass filter which rejects signals outside the VOR band of 108.0 to 118.0-MHz. The preamp has a nominal gain of 12.0 (-0.0, +1.0)-db. Power is applied to preamp No. 1 from the dc standby bus by closing the NO. 1 NAVIGATION-VHF DC-PREAMP circuit breaker. Power is applied to preamp No. 2 from the No. 2 dc bus by closing the NO. 2 NAVIGATION-VHF DC-PREAMP circuit breaker (Ref. Fig. 2). Bypass circuits automatically bypass the amplifier portion with loss of DC power resulting in up to 3.5 db loss of signal.

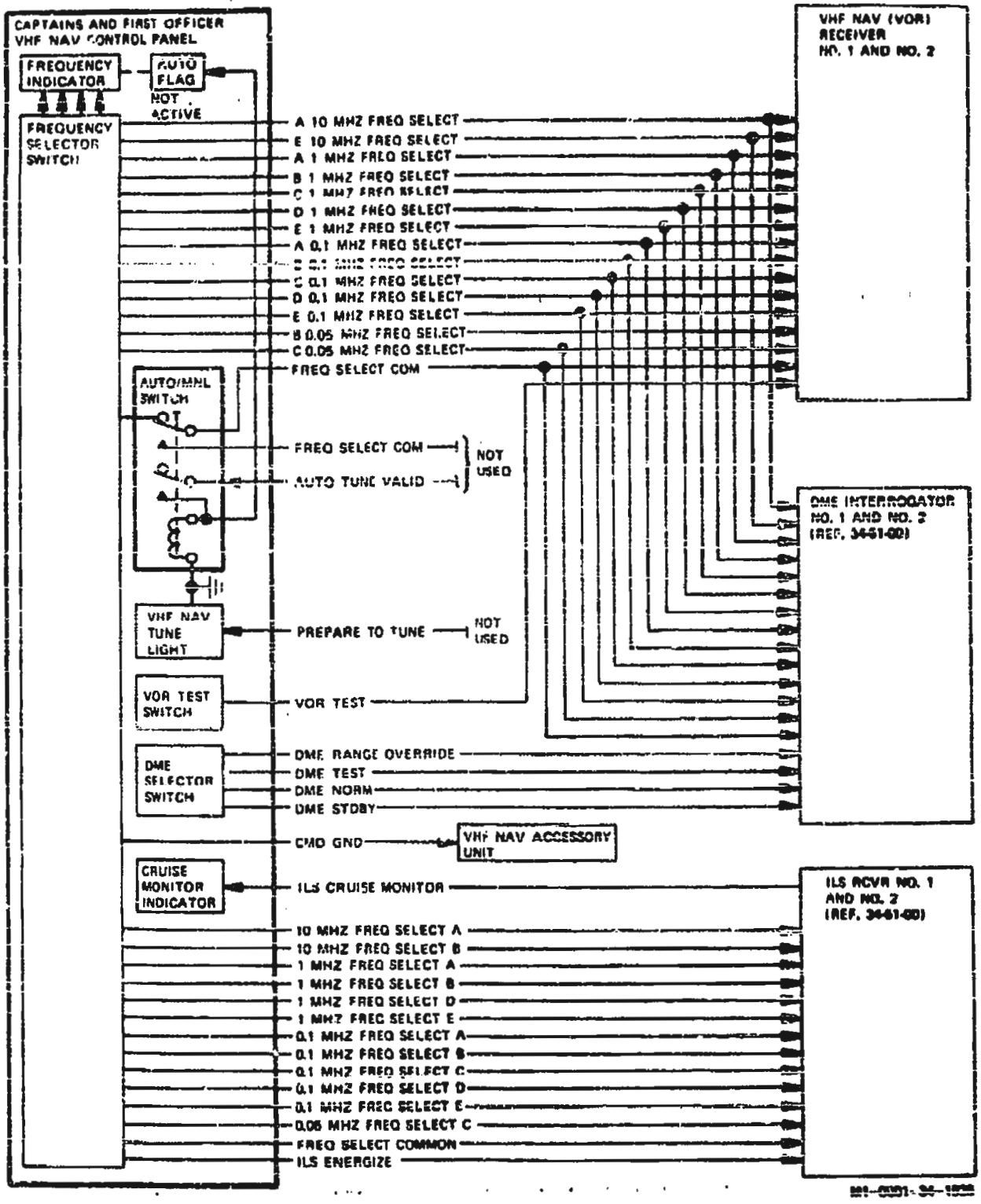
R
R
R

6. Horizontal Situation Indicator (HSI)

A. Description

The horizontal situation indicator (HSI) provides the following:

Repeated heading display


CAPTAINS AND FIRST OFFICER VHF NAV CONTROL PANEL
FREQUENCY INDICATOR
AUTO FLAG
NOT ACTIVE
FREQUENCY SELECTOR SWITCH
AUTO/MNL SWITCH
VHF NAV TUNE LIGHT
VOR TEST SWITCH
DME SELECTOR SWITCH
CRUISE MONITOR INDICATOR
A 10 MHZ FREQ SELECT
E 10 MHZ FREQ SELECT
A 1 MHZ FREQ SELECT
B 1 MHZ FREQ SELECT
C 1 MHZ FREQ SELECT
D 1 MHZ FREQ SELECT
E 1 MHZ FREQ SELECT
A 0.1 MHZ FREQ SELECT
C 0.1 MHZ FREQ SELECT
D 0.1 MHZ FREQ SELECT
E 0.1 MHZ FREQ SELECT
B 0.05 MHZ FREQ SELECT
C 0.05 MHZ FREQ SELECT
FREQ SELECT COM
FREQ SELECT COM
AUTO TUNE VALID
NOT USED
PREPARE TO TUNE
NOT USED
VOR TEST
DME RANGE OVERRIDE
DME TEST
DME NORM
DME STDBY
CMD GND
VHF NAV ACCESSORY UNIT
ILS CRUISE MONITOR
10 MHZ FREQ SELECT A
10 MHZ FREQ SELECT B
1 MHZ FREQ SELECT A
1 MHZ FREQ SELECT B
1 MHZ FREQ SELECT D
1 MHZ FREQ SELECT E
0.1 MHZ FREQ SELECT A
0.1 MHZ FREQ SELECT B
0.1 MHZ FREQ SELECT C
0.1 MHZ FREQ SELECT D
0.1 MHZ FREQ SELECT E
0.05 MHZ FREQ SELECT C
FREQ SELECT COMMON
ILS ENERGIZE
VHF NAV (VOR) RECEIVER NO. 1 AND NO. 2
DME INTERROGATOR NO. 1 AND NO. 2 (REF. 34-51-00)
ILS RCVR NO. 1 AND NO. 2 (REF. 34-61-00)

R
R

VHF NAV Control Panel Block Diagram
Figure 4

EFFECTIVITY: ALL

001B

Selected heading display

CR Selected course display (pointer and digital readout),
CR (Digital readout not incorporated in some HSIs)

Glideslope (GS) deviation indication

Course deviation indication

True/magnetic-heading failure mode annunciation

To-from indication

Glideslope (GS) failure warning flag

Course deviation (NAV) warning annunciation

MEMory annunciation

Leg change ALERT annunciation

Navigation source mode annunciation (VOR-ILS-R/NAV)

Navigation system annunciation (1 or 2)

Distance-to-go (DISTANCE) readout (INS)

Groundspeed (GND SPD) readout (INS)

Time-to-station (TIME) readout (INS)

The HSI is housed in a 5.01-inch, by 9.00-inch, by 5.08-inch black case. Two HSIs are mounted in the aircraft: one is located on the Captains instrument panel, zone 211, and the other is located on the First Officers instrument panel, zone 212. The HSI provides the following displays (Ref. Fig. 5):

(1) Aircraft Symbol

A miniature aircraft symbol is located near the center of the indicator window. The forward direction of the miniature aircraft is toward the top of the instrument face.

(2) Heading Dial

A servo-driven, circular, rotating dial displays repeated aircraft heading in conjunction with the heading lubber line. The heading dial can also be used as the readout for selected course and selected

heading. The dial is provided with 5 degree graduation marks.

(3) Heading Index Marks

The following six fixed reference marks are located around the outside of the heading dial; a heading lubber line at the top of the display against which heading is read, a reciprocal heading mark at the bottom of the display, and 45 and 90-degree marks on either side of the heading lubber line.

(4) Heading Select

An open triangle (bug) indicates the selected heading on the heading dial. The heading select indicator is remotely positioned by heading select signals. These heading select signals are differential transmitter outputs which represent the heading angle selected, minus the actual aircraft heading angle.

(5) Course Select

Selected course information is displayed on the heading dial by a dagger-shaped indicator. A pointer opposite the dagger-shaped indicator displays the reciprocal of the selected course. The dagger and pointer, together with the aircraft symbol, also serve as an index for the deviation indicator.

NOTE: When in INS mode of operation, the course select signal is replaced by the TKE+DA (track angle error + drift angle) signal from the INS (Ref. 34-43-00).

CR CR (6) Course Select Counter Readout (Not incorporated in some HSIs)

A three-integer display element located in the upper left-hand corner of the instrument displays the selected course in degrees. This is mechanically coupled to the dagger-shaped course select pointer.

(7) Course Deviation

Course deviation information is displayed by a bar which moves across a scale affixed to the rotating mask near the center of the indicator face. The scale markings consist of four matte-white dots (two on either side of the scale).

(8) Glideslope Deviation

Glideslope deviation information is displayed by a pointer on the glideslope vertical scale located near the center of the right side of the instrument face. Aircraft above the glideslope beam is indicated by the pointer below the scale index. Aircraft below the glideslope beam is indicated by the pointer above the scale index.

(9) Numerical Readouts

Three numerical readout elements display distance, time, and ground speed information. Distance information is displayed on the four-digit DISTANCE element located in the upper right-hand corner. Time information is displayed on the three-digit TIME element located in the lower left-hand corner. Ground speed information is displayed on the GND SPD element located in the lower right-hand corner.

(a) DISTANCE Display

With the INS operating, the DISTANCE window indicates distance remaining in nautical miles to the next way point.

(b) TIME Display

With the INS operating, the TIME window indicates time remaining in minutes to reach the next way point.

(c) GND SPD Display

With the INS operating, the GND SPD window indicates aircraft ground speed.

NOTE: Readouts are shuttered during RADIO mode of operation.

(10) Alert Annunciator

An ALERT light comes on (located to the left of the heading dial)prior to a leg change when the RADIO/INS switchlight is in INS position.

(11) Memory Annunciator

A MEM light comes on (located below the ALERT annunciator) to indicate the INS system is in the dead reckoning mode.

(12) To-From Display

A triangular pointer appears on the course mask, pointing toward the course select pointer, to indicate that the aircraft is flying to the selected VOR station. The pointer appears on the opposite side to indicate that the aircraft is flying away from the selected VOR station. Neither pointer is in view when the aircraft is over the selected VOR station.

During INS mode,the pointer will point toward the course select pointer until the last waypoint on the selected route has been overflown. The to-from pointer is controlled by the INU.

(13) Heading Source - Heading Failure Annunciator

The legends TRUE, MAG, or HDG appear in a window just above the lubber line to indicate the heading dial servo input sources, MAG (magnetic) from the magnetic heading reference system, or TRUE heading from the inertial system. If either input, or the heading portion of the HSI fails, HDG will come into view.

(14) Navigation Source Annunciator

The left window located below the heading dial indicates either R-NAV, VOR, or ILS. R-NAV will appear if input is from INS. The right window below the heading dial indicates either 1 or 2.

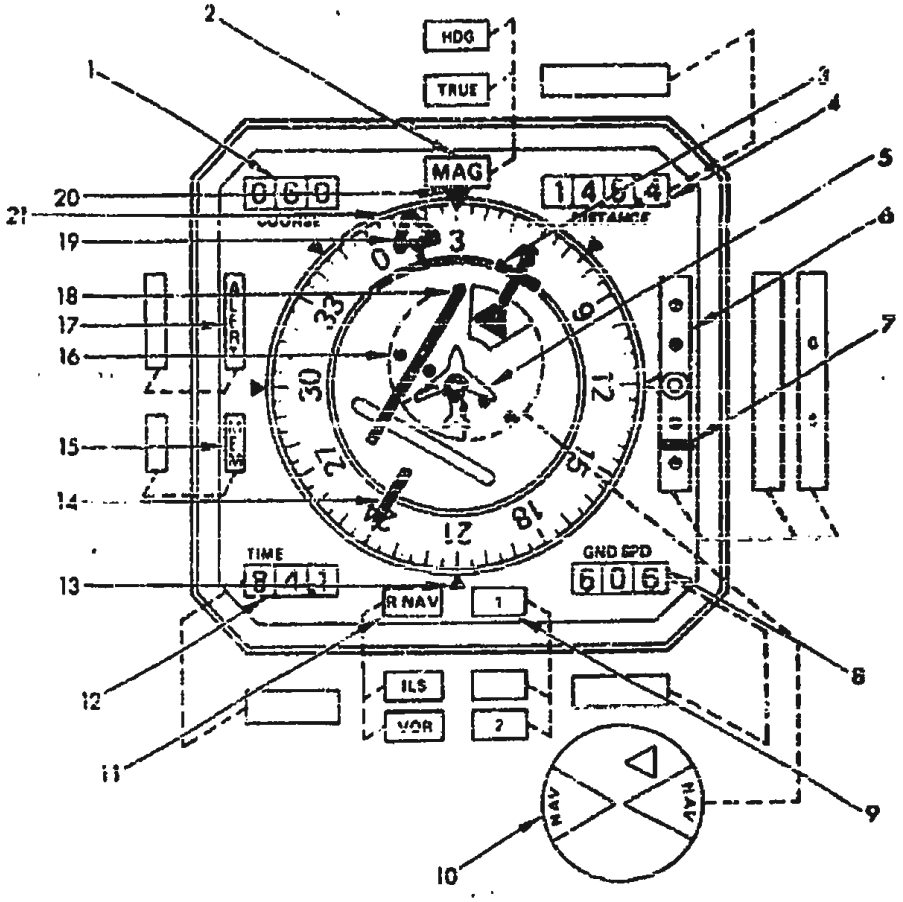
B. Operation

(1) Power

The Captains and First Officers HSI each receive 115 V ac, 400-Hz primary power from separate circuit breakers on the pilots overhead circuit breaker panel CB1, zone 210. Primary power is applied to the Captains HSI by closing the NO. 1 INSTRUMENT-CAPT HSI circuit breaker. Primary power is applied to the First Officers HSI by closing the NO. 2 INSTRUMENTS-F/O HSI circuit breaker. The primary power is applied to internal power supplies which provide the operating voltages for the HSI (Ref. Fig. 6).

(2) Heading Servo

The heading servo receives three-wire input signals representing aircraft heading. The servo consists of a transolver, a servo amplifier, an ac torque motor, and a gear train. The transolver applies heading signals to the servo amplifier which provides the motor control field input power. The motor drives the gear train



1. SELECTED COURSE COUNTER
2. HEADING SOURCE ANNUNCIATOR AND FAILURE WARNING DISPLAY
3. SELECTED COURSE POINTER
4. DISTANCE COUNTER
5. AIRPLANE SYMBOL
6. GLIDESLOPE DEVIATION SCALE AND FAILURE WARNING DISPLAY
7. GLIDESLOPE DEVIATION POINTER
8. GROUND SPEED DISPLAY
9. NAVIGATION SYSTEM ANNUNCIATOR
10. TO-FROM ANNUNCIATOR AND FAILURE WARNING DISPLAY (NAV FLAG)
11. NAVIGATION SOURCE ANNUNCIATOR
12. TIME DISPLAY
13. RECIPROCAL HEADING INDEX
14. RECIPROCAL SELECTED COURSE (BACKCOURSE) POINTER
15. MEMORY ANNUNCIATOR
16. SELECT COURSE DEVIATION SCALE
17. ALERT ANNUNCIATOR
18. SELECT COURSE DEVIATION BAR
19. SELECT HEADING BUG
20. HEADING INDEX
21. HEADING DIAL

NOTE

1. NOT INCORPORATED INTO SOME HSI'S

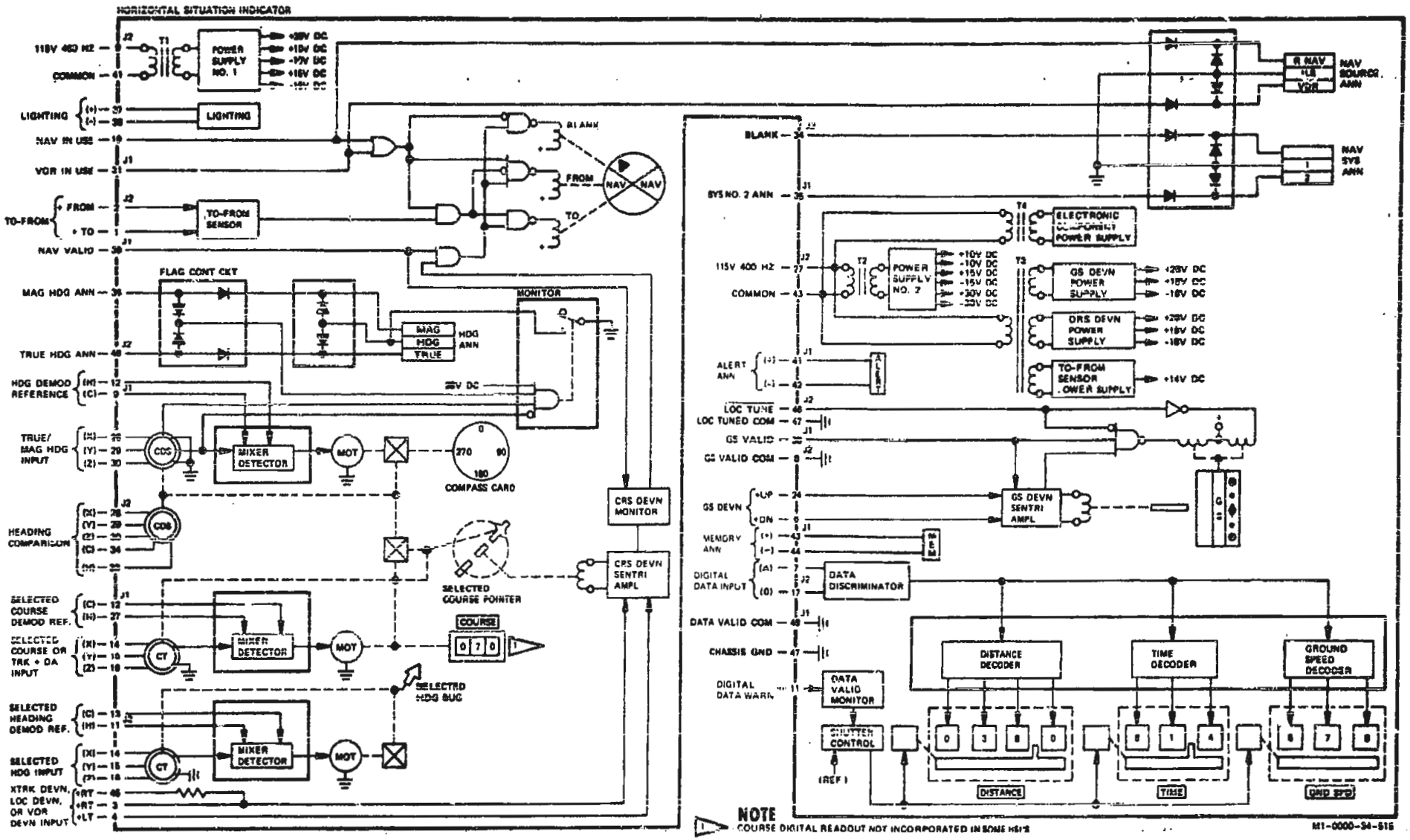
MI-[illegible]-34-511

CR
CR

Horizontal Situation Indicator
Figure 5

EFFECTIVITY: ALL

001B



Horizontal Situation Indicator – Block Diagram
Figure 6

EFFECTIVITY: ALL

001B

which positions the heading dial and drives the transolver to null the gear train.

A heading comparison transolver is also driven to provide a heading null or error signal to the heading channel in the instrument comparison monitor (ICM). The ICM output controls a HEADING annunciation on the INSTR COMPARATOR panel (Ref. 34-16-00). The heading failure warning (HDG) flag is controlled through logic circuits in the HSI heading monitor. A heading valid input signal (superflag) is connected directly to the high side of the flag. The monitor provides a ground to the low side of the flag. The HDG flag on the HSI will come into view if any of the following conditions exist:

Absence of primary power

Absence of heading input signal

Presence of persistent excessive servo null

Open circuit in input or feedback transolver winding

Absence of transolver excitation

Absence of heading valid (superflag) signal

(3) Heading Select Servo

The heading select servo receives three-wire input signals representing the heading select angle minus the heading angle. The servo consists of a synchro control transformer, a demodulator, a servo amplifier, a dc torque motor, and a gear train. In normal operation, the control transformer applies the heading select signals to the demodulator, the demodulated signals are then applied to the servo amplifier. The amplifier provides the motor control field input power. The motor drives the gear train which positions the heading select triangle and drives the control transformer to null.

(4) Course Select Servo

The course select servo receives three-wire input signals representing the course select angle minus the heading angle. The servo consists of a synchro control transformer, a demodulator, a servo amplifier, a dc torque motor, and a gear train. The control transformer applies the course select signals to the

demodulator, the demodulated signals are then applied to the servo amplifier. The amplifier provides the motor control field input power. The motor drives the gear train, positioning the dagger-shaped indicator, the COURSE digital readout, and nulling the control
CR transformer. (Course digital readout not incorporated
CR in some HSIs)

(5) Course Deviation Bar

Course deviation is indicated by applying localizer, VOR, or INS signals to a closed-loop circuit. The signals are amplified and routed through a torquer and feedback meter circuit which moves the bar across a scale to indicate course deviation.

The navigation warning flag is controlled by course deviation valid input signals to the course deviation monitor logic circuits. The flag comes into view if any of the following conditions exist:

Absence of primary power

Failure of internal power supply

Open meter torque winding

Open feedback winding

Loss of course deviation valid input from VOR, localizer, or INS.

(6) Glideslope Deviation Scale

The glideslope deviation scale is displayed when the glideslope flag is valid, the localizer tuned ground is present, and the glideslope [(SENTRI) (Sperry Electronic Null Tracking and Retraction Instrumentation)] amplifier is valid. The glideslope deviation pointer and scale are a conventional meter mechanism.

If a VOR station is selected (localizer tuned ground signal is not present), a black shutter is displayed and the glideslope deviation pointer will center. At this time the flag is controlled by the internal monitor. If the localizer tuned ground signal is present, the GS flag will appear in view if any of the following conditions exist:

Localizer tuned ground signal missing

Loss of glideslope valid signal

Absence of primary power

Failure of internal power supply

Open meter torque winding

Open feedback winding

(7) DISTANCE, TIME, and GND SPD Readouts

The distance, time, and ground speed readouts are controlled by the BCD outputs from the inertial system (Ref. 34-43-00). The BCD input data is processed and decoded by the BCD decoder and driver circuits. The BCD decoder and driver circuits drive the four-digit DISTANCE element and the three-digit TIME and GND SPD elements. These readout elements have shutters which cover the particular display if any of the following conditions exist:

Absence of primary power

Failure of internal power supply

Absence of input data

Absence of external data valid signal

7. VHF NAV (Dual VOR) Antenna System

A. Description and Operation

The VHF NAV (dual VOR) antenna system consists of a feed assembly and two fiber glass panels containing E-shaped elements. Each element is imbedded in a fiber glass panel which are flush-mounted on either side of the vertical stabilizer, they are 21.06-inches long and 20.22-inches high. When the panels are mounted, the center leg of each E-shaped element makes contact with the antenna feed assembly (balun), and the outer legs make contact with the vertical stabilizer structure to complete the circuit. The two element antenna provides omnidirectional coverage. The VHF NAV (dual VOR) antenna receives VOR signals within the range of 180 to 118-MHz. The antenna received signals are connected to the feed assembly which provides two separate matched outputs through coaxial cables to the VOR preamplifiers.

6. VHF NAV Accessory Unit

A. Description

The VHF NAV accessory unit contains relays that switch signals between the aircraft navigation equipment. These relays are controlled by switches in the Captains and First Officers VHF NAV control panel, the Captains and First Officers instrument source select panel, the NAV MODE select panel, and the RADIO/INS switchlights (with INS installed). The accessory unit contains two input connectors and two output connectors. It is divided into two sections: the Captains switching section and the First Officers switching section. The VHF NAV accessory unit is located on the rear rack of the forward electronic service center, zone 113.

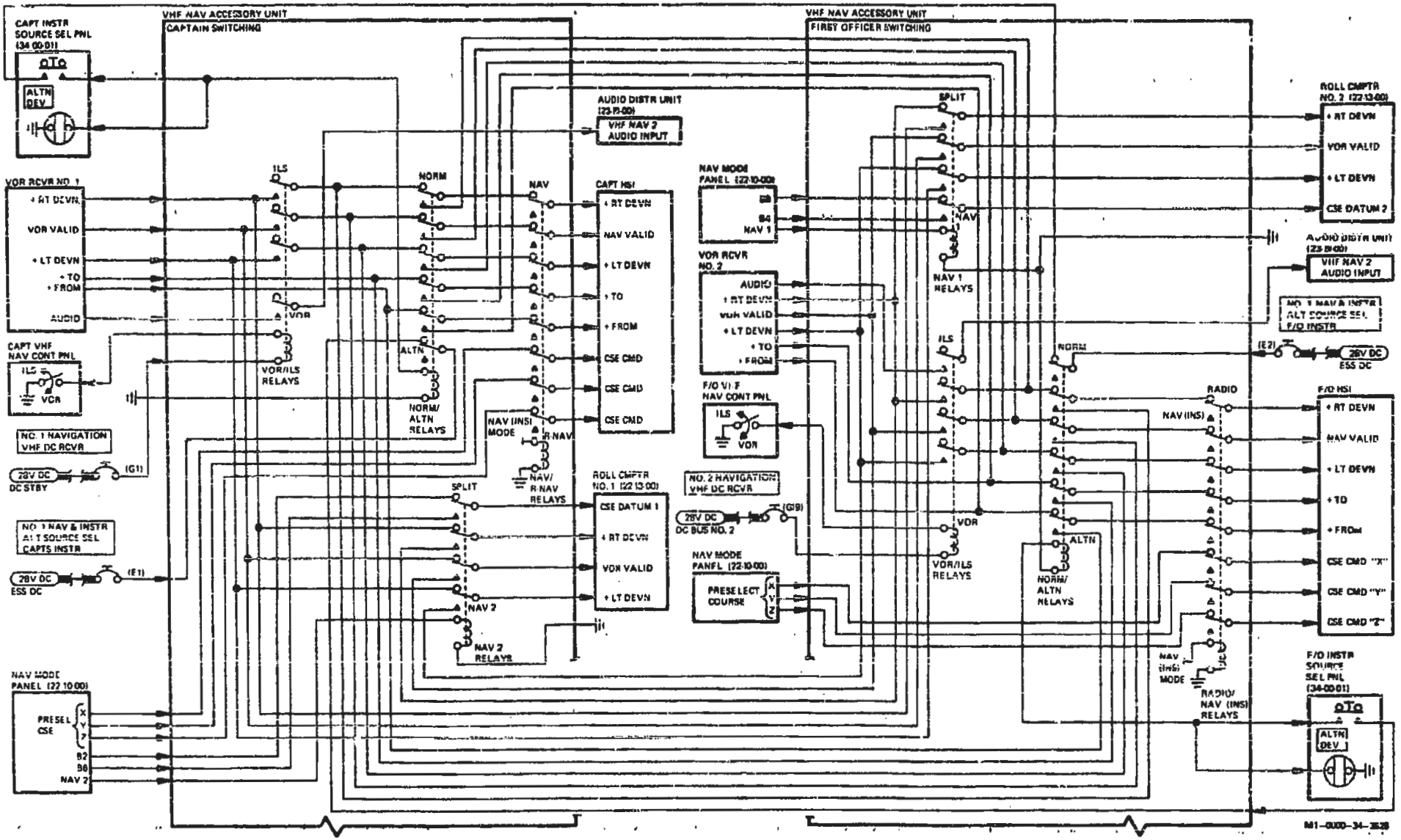
B. Operation

The Captains switching section and the First Officers switching section contain identical relay switching circuits. The VHF NAV accessory unit switches outputs from the VOR receivers, the ILS receivers (Ref. 34-33-00), the NAV MODE select panel (Ref. 22-10-00) and the INS (with INS installed).

(1) VOR Operation

When the Captain or First Officer selects a VOR frequency, using the frequency selector knob on the Captains or First Officers VHF NAV control panel, a CMD GND (command ground) signal is applied to the applicable VOR/ILS relay coils (Ref. Fig. 7), energizing the relays and closing the VOR contacts. The VOR/ILS relays are failsafe to the ILS position (deenergized).

If the Captain or First Officer has not pressed the ALTN DEV switchlight on the Captains or First Officers instrument source select panel, the NORM/ALTN relays will not energize. The output signals from VHF NAV (VOR) receiver No. 1 are supplied through the closed contacts of the VOR/ILS relays, the NORM/ALTN relays, and deenergized contacts of the RADIO/NAV (INS) relays to the Captains HSI and the audio distribution unit (Ref. 23-51-00). The output signals from VHF NAV (VOR) receiver No. 2 are supplied through the closed contacts of the VOR/ILS relays, the NORM/ALTN relays, and the deenergized contacts of the RADIO/NAV (INS) relays to the First Officers HSI and the audio distribution unit. A 28V dc VOR superflag signal is supplied straight through the VHF NAV accessory unit to the Captains and First Officers RDDMI.



R R VHF NAV Accessory Unit, VOR Operation, Block Diagram
Figure 7

EFFECTIVITY: ALL

001B

If the ALTN DEV switchlight on the Captains instrument source select panel is pressed, the NORM/ALTN relays in the Captains switching section are energized by 28V dc through normally closed contacts of a NORM/ALTN relay in the First Officers switching section and Captains ALTN DEV switchlight. This allows the Captains HSI to receive signals from VHF NAV (VOR) receiver No. 2. If the ALTN DEV switchlight on the First Officers instrument source select panel is pressed, the NORM/ALTN relays in the First Officers switching section are energized by 28V dc through the normally closed contacts of a NORM/ALTN relay in the Captains switching section and the First Officers ALTN DEV switchlight. This allows the First Officers HSI to receive signals from VHF NAV (VOR) receiver No. 1.

The VOR selector (SPLIT-1-2) on the NAV MODE select panel (Ref. 22-10-00) is normally in the SPLIT position. To select 1 or 2, either autopilot or flight director must be engaged in the NAV mode.

When the VOR selector switch on the NAV MODE select panel is placed in the SPLIT position, the SPLIT NAV 2 relay in the Captains switching section and the SPLIT NAV 1 relay in the First Officers switching section remain deenergized. The + right deviation, course deviation flag, and + left deviation signals from VHF NAV (VOR) receiver No. 1 are switched through the normally closed (SPLIT) contacts and applied to roll computer No. 1 (Ref. 22-13-00). The same signals from VHF NAV (VOR) receiver No. 2 are applied to roll computer No. 2. If the VOR selector on the NAV MODE select panel is placed in the 1 position, the SPLIT NAV 1 relay in the First Officers switching section is energized by a 28V dc signal from the NAV MODE select panel. With the SPLIT NAV 1 relay energized, the NAV 1 contacts close. The + right deviation, course deviation flag, and + left deviation signals from VHF NAV (VOR) receiver No. 1 are applied to roll computer No. 1 and roll computer No. 2. If the VOR selector on the NAV MODE select panel is placed in the 2 position, the SPLIT NAV 2 relay in the Captains switching section is energized. At this time, the SPLIT NAV 1 relay is deenergized. With the SPLIT NAV 2 relay in the energized state, the + right deviation, course deviation flag, and + left deviation signals from VHF NAV (VOR) receiver No. 2 are applied to roll computer No. 1 and roll computer No. 2. Course datum 1 and 2 outputs from the NAV MODE select panel are switched at the same time.

(2) ILS Operation

When the Captain or First Officer selects an ILS frequency on the applicable VHF NAV control panel, using the frequency selector knob on the Captains or First Officers VHF NAV control panel, the VOR command ground (CMD GND) signal is removed, deenergizing the VOR/ILS relays in the VHF NAV accessory unit to the ILS position. The relays are fail-safe (deenergized) to the ILS position (Ref. Fig. 8).

Glideslope (GS) and localizer (LOC) signals from ILS receiver No. 1 and ILS receiver No. 2 are routed through the VOR/ILS relays, the NORM/ALTN relays and the RADIO/NAV (INS) relays to the Captains and First OFICERS HSI. If the ALTN DEV switchlight on the Captainr instrument source select panel is pressed, output signals from ILS receiver No. 2 are displayed on the Captains and First Officers HSI. If the ALTN DEV switchlight on the First Officers instrument source select panel is pressed, output signals from ILS receiver No. 1 are displayed on the Captains and First Officers HSI.

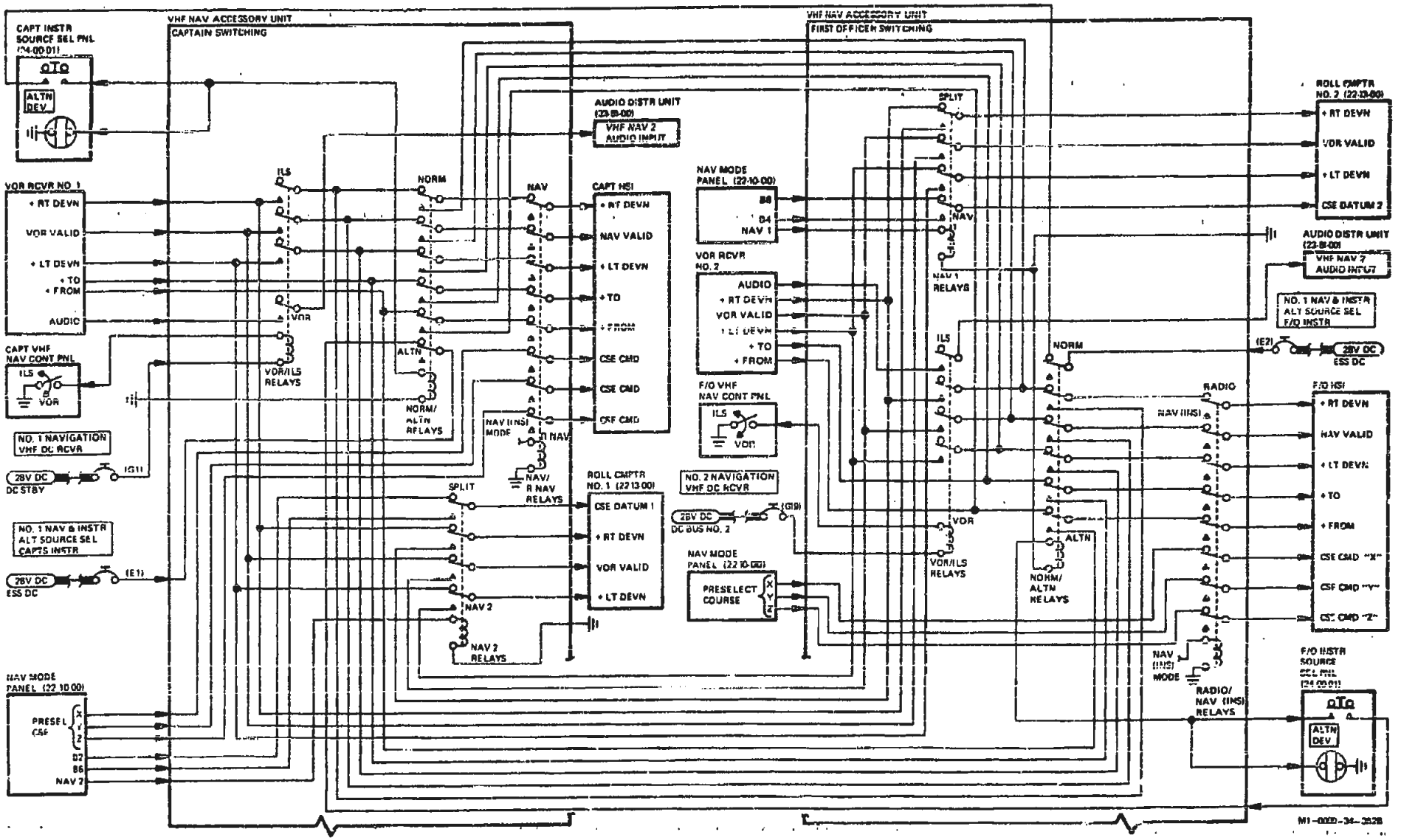
The glideslope and localizer signals from ILS receivers No. 1 and No. 2 also go to the Captains and First Officers attitude director indicator (ADI), respectively, but straight through without any effect of relay switching.

(3) AFCS Operation

If the VOR selector switch on the NAV MODE select panel is placed in the SPLIT position, course datum No. 1 information is applied to AFCS yaw computer No. 1 (Ref. 22-15-00) and through the SPLIT NAV 2 relay contacts to roll computer No. 1 (Ref. 22-13-00). Course datum No. 2 information is applied to AFCS yaw computer No. 2 and to roll computer No. 2. If the VOR selector switch is placed in the 1 position, the SPLIT NAV 1 relay is energized. The course datum No. 1 output is applied to roll computer No. 1 and roll computer No. 2. If the VOR selector switch is placed in the 2 position, the SPLIT NAV 2 relay is energized. The course datum No. 2 output signal is applied to roll computer No. 1 and roll computer No. 2 (Ref. Fig. 9).

(4) Inertial Navigation System Operation

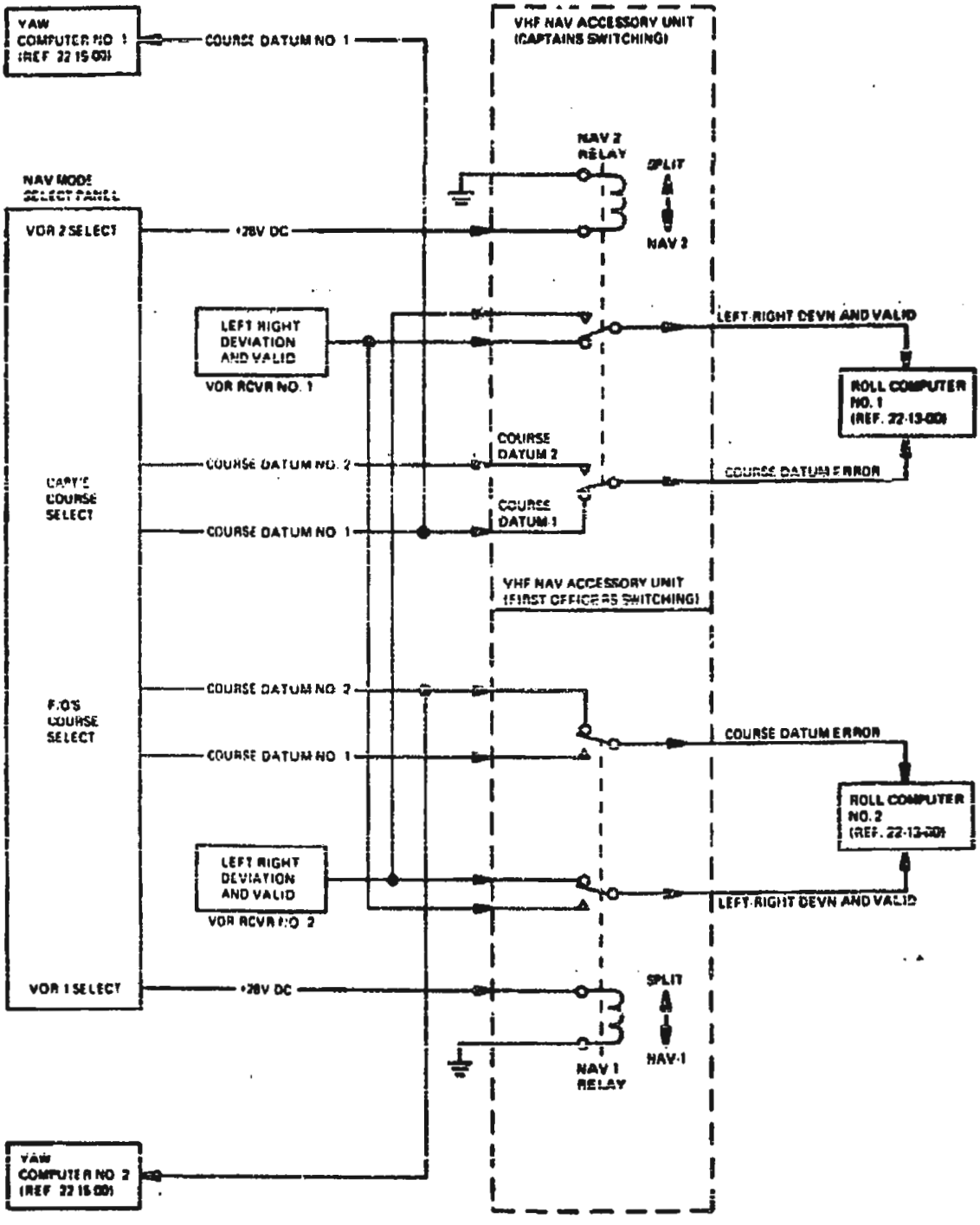
If the Captain has selected a VOR frequency, the VOR/ILS relays in the VHF NAV Accessory Unit will be energized. The Captain can now select INS mode on his RADIO/INS switchlight. This will energize the RADIO/NAV (INS) relays in the VHF NAV accessory unit to



R VHF NAV Accessory Unit, ILS Operation, Block Diagram
R Figure 8

EFFECTIVITY: ALL

001B



R VHF NAV Accessory Unit, AFCS Operation, Block Diagram
R Figure 9

the INS (R-NAV) position. The following INS outputs are now supplied straight through the R-NAV Accessory Unit, through the closed R-NAV (INS) relay contacts in the VHF NAV Accessory Unit to the Captains HSI:

Lateral Navigation Flag

Track Angle Error Plus Drift Angle

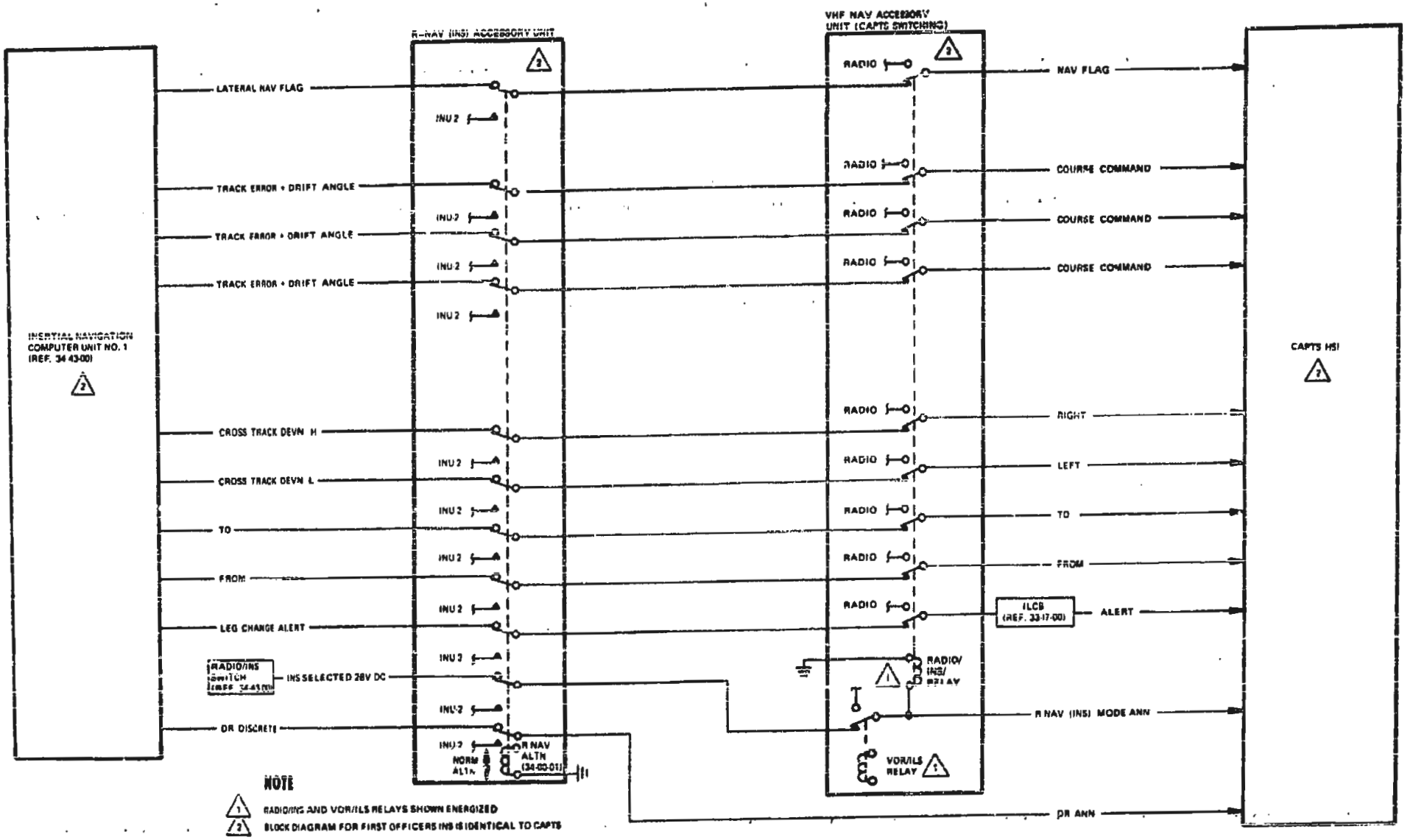
Crosstrack Deviation

To - From Signal

Leg Change Alert Signal

When the INS mode is selected on the Captains RADIO/INS switchlight, 28V dc is supplied through the energized RADIO/NAV (INS) relays in the VHF NAV Accessory Unit to bring the R-NAV mode annunciator into view at the bottom of his HSI.

The same procedure will take place when the First Officer selects a VOR frequency and selects INS mode. In this case the appropriate relays in the VHF NAV Accessory Unit concerning the First Officer will be energized (Ref. Fig. 10).



NOTE

1. RADIO/INS AND VOR/ILS RELAYS SHOWN ENERGIZED
2. BLOCK DIAGRAM FOR FIRST OFFICERS INS IS IDENTICAL TO CAPTS

MI 0000-34-3627

R VHF NAV Accessory Unit, INS Operation, Block Diagram
R Figure 10

EFFECTIVITY: ALL

0018

VOR SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code, the code number can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for a more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematic.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination.

To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics, listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Supplemental Fault Isolation Data

C A. VHF Nav Frequency Selection Trouble Shooting

CR C C C NOTE: If a log book write-up states a VOR/ILS system is inoperative on some frequencies, or specifies the frequencies, confirmation that corrective action has been effective must be made:

C CR C • by using an R and R 90150 ramp tester, or equivalent, and checking that all combinations of VOR/ILS frequencies are operative; or

C C • by using an R and R 90150 ramp tester or equivalent and checking that the frequencies noted in the log book are

CR C operative. Use of fixed-frequency testers, R and R 90166, 90179, and 90180 will not insure effective correction.

CR CR CR CR CR CR CR NOTE: If an R&R 90150 ramp tester or equivalent is not available and a flight delay or cancellation would result from obtaining a tester, ramp testers R&R 90166, 90179, or 90180 may be used, a log book note made that the system was checked only on the single frequency and the MCIMD Maintenance Coordinator notified to have the system tested with an R&R 90150 tester at the first station so equipped.

C C C C C C (1) Trouble shooting malfunctions in VHF NAV frequency selection circuits, or confirming a problem, may be expedited by use of the following test which will reveal faults in wiring from control unit to receiver, or in control unit itself (assuming receiver has been eliminated as source of problem):

C (a) Select 112.2-MHz. Perform a VOR/ILS self-test.

C (b) Select 114.4-MHz. Perform a VOR/ILS self-test.

C (c) Select 116.6-MHz. Perform a VOR/ILS self-test.

C C C C (2) If the NAV (V/L) flag fails to retract on one or more of the above test frequencies, a fault exists in the frequency control wiring or in the VHF NAV control unit itself.

C C C C NOTE: This test does not check the 0.05-MHz wire. Although the 10-MHz wires are installed in the aircraft, they are of no concern as they are not utilized inside the NAV receiver.

C C C C C (3) By noting which frequency or frequencies fail the test and by referring to the following "two out of five" chart (See Figure 101), an idea may be gained as to which wire or wires may exhibit the fault (open, shorted to ground or shorted to another wire).

B. VOR Antenna Jumper Cable Assembly

A coaxial cable and a T-connector are stowed at aft rack in forward electronics service center (Ref. Fig. 102).

The coaxial cable and T-connector allow operation of both VOR receivers from a single antenna element, feed assembly and preamplifier. The coaxial cable and T-connector may be used as an aid in isolating faults to an antenna element, coaxial cable, feed assembly, or preamplifier. To prepare

coaxial cable and T-connector (VOR jumper cable assembly) for use; refer to Figure 102 and proceed as follows:

(1) Release two cable clamps securing VOR jumper cable assembly to outboard side (rear) of shelf No. 3 on rear rack in FESC, Zone 113.

(2) Disconnect coaxial cable from T-connector.

(3) Tag and disconnect suspect VOR antenna input cable at rack disconnect.

(4) Connect one female end of T-connector to rack disconnect where suspect VOR antenna input cable was disconnected in Step (3).

(5) Disconnect second VOR antenna input cable from rack disconnect and connect to male end of T-connector.

(6) Connect male end of coaxial cable to second female end of T-connector and connect female end of coaxial cable to rack disconnect where VOR antenna input cable was disconnected in Step (5).

(7) Both VOR receivers are now connected to operate from a single preamplifier and single antenna feed assembly

1 MHz OR 0.1 MHz FREQUENCIES

	1	2	3	4	5	6	7	8	9	0
A	X	X						X	X	
B	X		X	X						X
C		X	X		X	X				
D				X	X		X	X		
E						X	X		X	X

X DENOTES WIRES GROUNDED

BY NOTING WHICH FREQUENCY OR FREQUENCIES FAIL THE TEST AND BY REFERRING TO THE "TWO OUT OF FIVE" CHART, AN IDEA MAY BE GAINED AS TO WHICH WIRE OR WIRES MAY EXHIBIT THE FAULT (OPEN, SHORTED TO GROUND OR SHORTED TO ANOTHER WIRE)

NOTE

THIS TEST DOES NOT CHECK THE 0.05 MHz WIRE. ALTHOUGH THE 10 MHz WIRES ARE INSTALLED IN THE AIRCRAFT, THEY ARE OF NO CONCERN AS THEY ARE NOT UTILIZED INSIDE THE VOR RECEIVER

M1-0100-34-388

Two out of Five Chart
Figure 101

input coaxial cable. Perform VOR system adjustment and test procedure, verify both VOR systems are operational (Ref. 34-55-00, 501).

NOTE: Gain of both VOR receivers will be lowered in this configuration due to mismatch in antenna input line.

(8) If both systems are operational and lack of time does not permit repair or replacement of faulty antenna input coaxial cable, aircraft may be dispatched in this configuration at the operators discretion. Faulty antenna input coaxial cable should be repaired or replaced as soon as time permits.

(9) If aircraft is to be dispatched; cap and stow antenna input cable disconnected in Step (3), note VOR system configuration.

NOTE: Noting of VOR system configuration must be accomplished to avoid needless replacement of receiver(s), preamplifier(s) and/or antenna components (panels or feed assembly due to low sensitivity) and/or short range flight discrepancies.

C. Coaxial Cables in Tail and Antenna Feed Assembly Resistance Measurements

The following procedures will be useful in determining a fault in the tail coaxial cables or antenna feed assembly.

R NOTE: The following resistance standards are approximations
R only. Readings outside the expected range may not
R indicate component failure. Actual failure will
R often be indicated by electrical opens or shorts
R (very high or low resistance readings).

R (1) Disconnect both antenna cables from the pre-amp.

R (2) Check resistance between center conductor and shield
R for each cable, also check resistance between the
R center conductors of the two cables. Resistance should
R be between .25 and 2 ohms.

R (3) Disconnect both antenna cables from the antenna feed
R assembly and disconnect both antenna straps from
R antennas (Ref. 34-55-05, 401).

R (4) With cables disconnected, check resistance between each
R center conductor and its associated shield. Verify
R very high resistance (open circuit).

R (5) Install jumper to short each antenna cable center
R conductor with its shield. On other end of each cable
R verify low resistance (short circuit) between center
R conductor and associated shield.

R (6) Chech resistance on antenna feed assembly between VOR 1
R and VOR 2 center conductors. Resistance should be
R between .5 and 1 ohm.

R (7) Check resistance on antenna feed assembly between VOR 1
R center conductor and associated shield. Repeat for VOR
R 2. Resistance should be between 40 and 60 ohms.

R (8) Remove jumpers from cables and reinstall cables,
R antenna straps, antennas and access panels as required.

C 3. VHF Nav Frequency Selection Trouble Shooting

C NOTE: If a log book write-up states a VOR/LOC system is
C inoperative on some frequencies or specifies the
C frequencies, confirmation that corrective action has been
C effective must be made--1) by using an R&R 90150 ramp
C tester or equivalent and checking all combinations of
C VOR/LOC frequencies are operative; or 2) by using an R&R
C 90105 ramp tester or equivalent and checking that the
C frequencies noted in the log book are operative. Use of
C fixed-frequency testers, R&R 90166, 90179, and 90180 will
C not insure effective correction.

C CAUTION: TO PREVENT INTERFERENCE WITH NAVIGATIONAL FACILITIES,
C THE CRM-555 WILL BE USED ONLY ON A FREQUENCY OF
C 108.00-MHz, FOR ROUTINE VOR TESTING AND 108.10-MHz FOR
C ROUTINE LOCALIZER TESTING. OTHER FREQUENCIES MAY BE
C USED WHERE CIRCUMSTANCES DEMAND. IT IS RECOMMENDED
C THAT THE UNIT NOT BE USED ON SAME FREQUENCIES AS LOCAL
C NAVIGATION FACILITIES. ALSO RADIATION OF SIGNALS ON
C UNUSED FREQUENCIES SHOULD BE KEPT AT THE LOWEST
C USEABLE LEVEL AND FOR THE SHORTEST POSSIBLE PERIOD OF
C TIME.

C A. Trouble shooting malfunctions in VHF NAV frequency selection
C circuits or confirming a problem may be expedited by use of
C the following test which will reveal faults in the wiring
C from the control unit to the receiver or in the control unit
C itself (assuming the receiver has been eliminated as the
C source of the problem):

C (2) Select 112.2-MHz. Perform a VOR/ILS self-test.

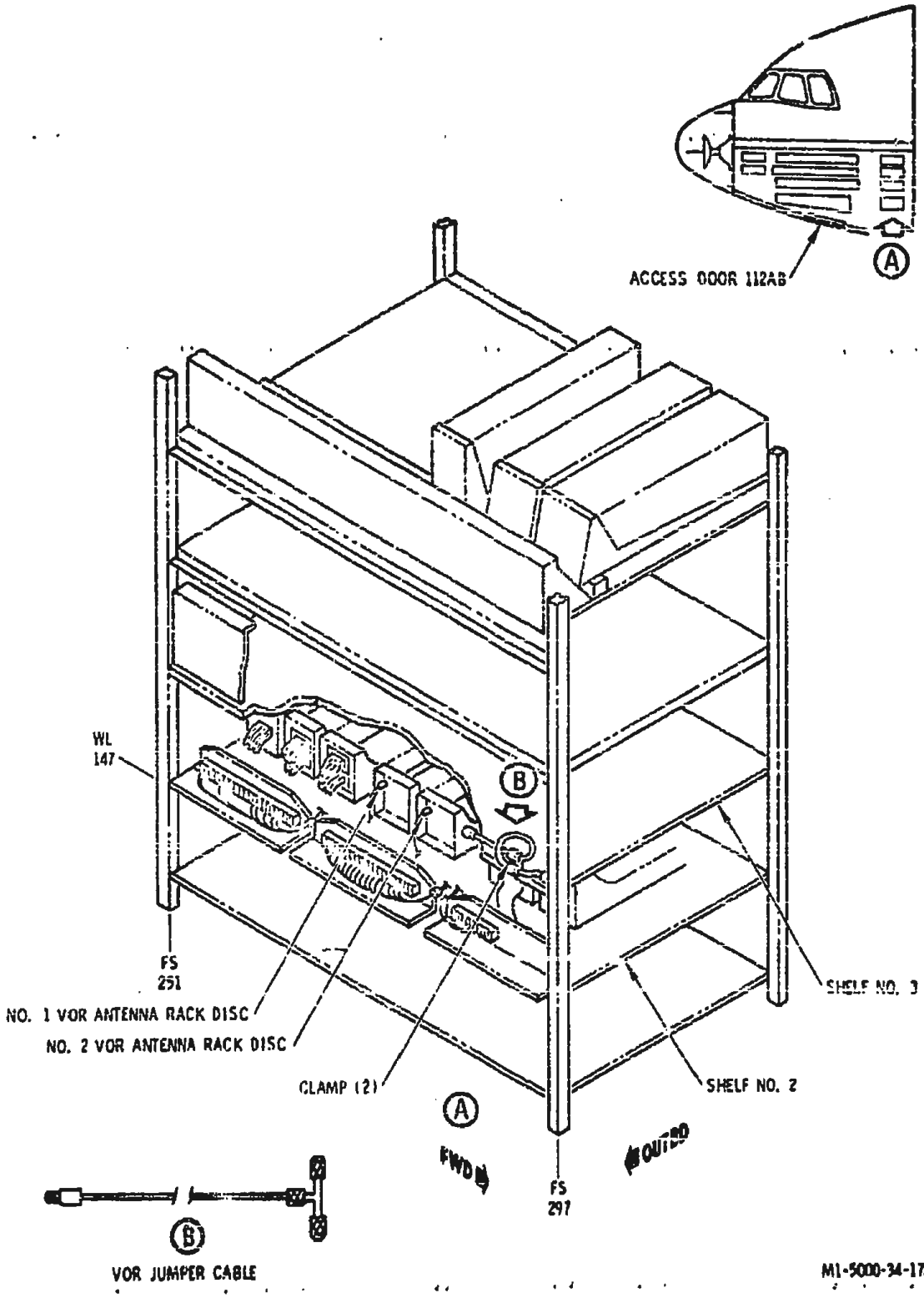
C (3) Select 114.4-MHZ. Perform a VOR/ILS self-test.

C (4) Select 116.6-MHz. Perform a VOR/ILS self-test.

B. If the NAV (V/L flag fails to retract on one or more of the above test frequencies, a fault exists in the frequency control wiring or in the VHF NAV control unit itself.

NOTE: This test does not check the 0.05 MHz wire. Also, although the 10 MHz wires are installed in the aircraft, they are of no concern as they are not utilized inside the NAV receiver.

C. By noting which frequencies fail the test and by referring to the following "two out of five" chart (See Figure 101), an idea may be gained as to which wire or wires may exhibit the fault (open, shorted to ground or shorted to another wire).



VOR Antenna Jumper Cable Assembly
Figure 102

3. Fault Isolation Identification

Table 101 lists the fault isolation diagrams and schematics in this section. Figures 103 and 104 provide component locations for the VOR system and associated components.

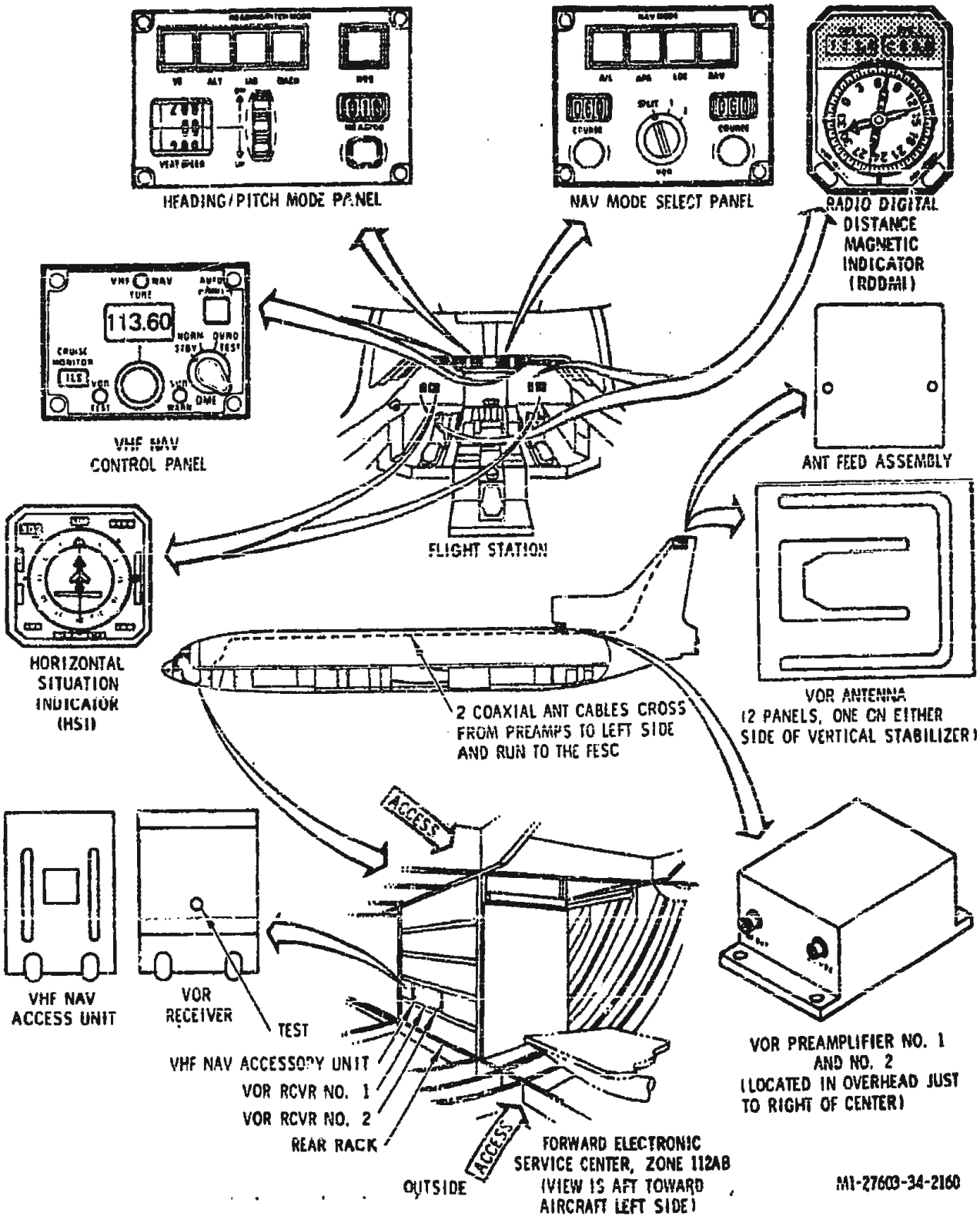
Fault Isolation Diagrams and Schematics List
Table 101

R R FIGURE NUMBER	TITLE
R 103	Component Location Index
R 104	VOR Component Locator Diagram
R 105	VOR Audio or Frequency Select Problem
R 106	Course/Heading Set Problem
R 107	VOR Problems
R SCHEM 1 (Sheet 1)	VOR System No. 2 Schematic
R SCHEM 1 (Sheet 2)	VOR System No. 1 Schematic
R SCHEM 1 (Sheet 3)	VOR System Schematic (Output Interface)
R SCHEM 1 (Sheet 4)	VOR System Schematic (Capt VHF Nav Access Unit)
R SCHEM 1 (Sheet 5)	VOR System Schematic (F/O VHF Nav Access Unit)
R SCHEM 1 (Sheet 6)	VOR System Schematic (RDDMI)
R SCHEM 1 (Sheet 7)	VOR System Schematic (HSI)
R SCHEM 2	VHF NAV Control Panel Schematic

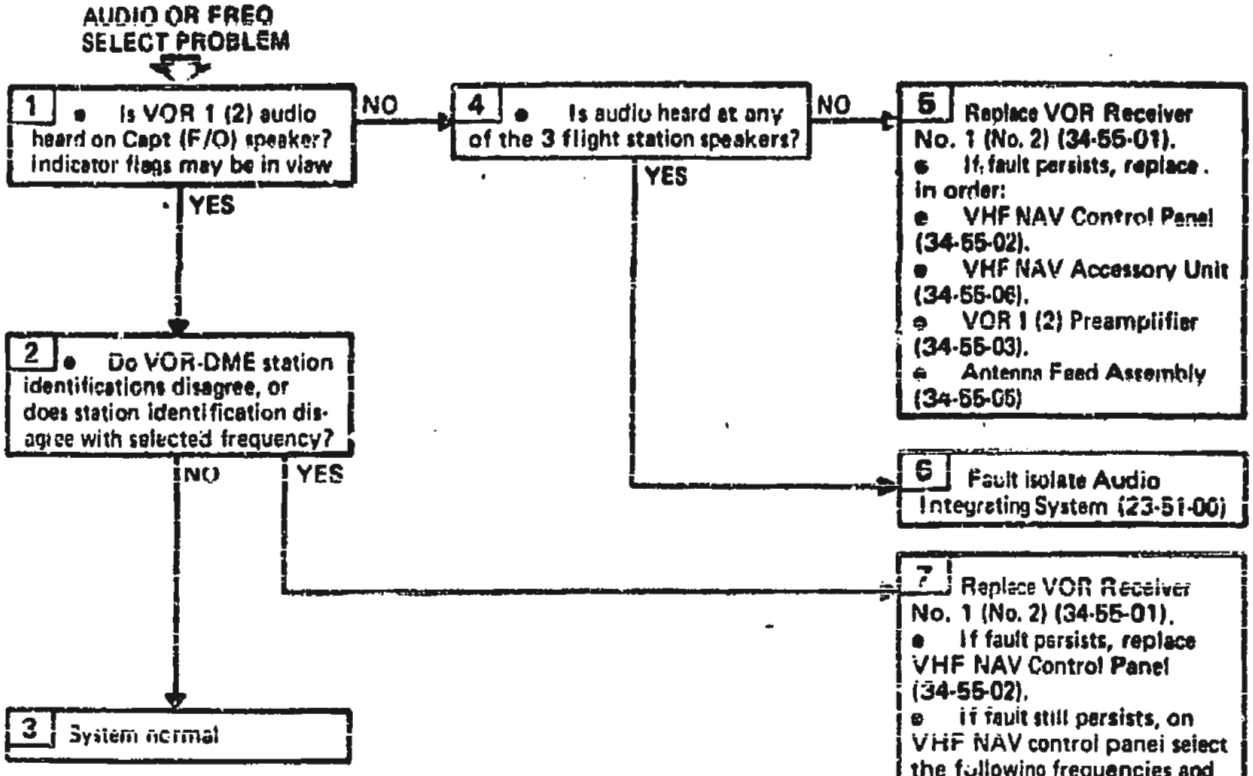
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ANTENNA – VOR (DUAL)	1	VERTICAL STAB	34-55-05
ASSEMBLY – ANT FEED (DUAL)	1	VERTICAL STAB	34-55-05
INDICATOR – HORIZONTAL SITUATION	2	FLT STA, CAPT & F/O INSTR PNL	34-55-04
INDICATOR – RADIO DIGITAL DISTANCE MAGNETIC (RDDMI)	2	FLT STA, CAPT & F/O INSTR PNL	34-57-08
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22-10-03
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLRSHLD PNL	22-10-02
PANEL – VHF NAV CONTROL	2	FLT STA, GLRSHLD PNL	34-55-02
PREAMPLIFIER – VOR	2	AFT CABIN	34-55-03
RECEIVER – VOR	2	FESC, REAR RACK/112AB	34-55-01
UNIT – VHF NAV ACCESSORY	1	FESC, REAR RACK/112AB	34-55-06

M1-0000-34-3336

Component Location Index
Figure 103


HEADING/PITCH MODE PANEL
NAV MODE SELECT PANEL
RADIO DIGITAL DISTANCE MAGNETIC INDICATOR (RDDMI)
VHF NAV CONTROL PANEL
ANT FEED ASSEMBLY
FLIGHT STATION
HORIZONTAL SITUATION INDICATOR (HSI)
VOR ANTENNA (2 PANELS, ONE ON EITHER SIDE OF VERTICAL STABILIZER)
2 COAXIAL ANT CABLES CROSS FROM PREAMPS TO LEFT SIDE AND RUN TO THE FESC
VHF NAV ACCESS UNIT
VOR RECEIVER
TEST
VHF NAV ACCESSORY UNIT
VOR RCVR NO. 1
VOR RCVR NO. 2
REAR RACK
ACCESS
OUTSIDE
FORWARD ELECTRONIC SERVICE CENTER, ZONE 112AB (VIEW IS AFT TOWARD AIRCRAFT LEFT SIDE)
VOR PREAMPLIFIER NO. 1 AND NO. 2 (LOCATED IN OVERHEAD JUST TO RIGHT OF CENTER)
M1-27603-34-2160

Component Locator Diagram
Figure 104


AUDIO OR FREQ SELECT PROBLEM
1 • Is VOR 1 (2) audio heard on Capt (F/O) speaker? Indicator flags may be in view
NO
YES
4 • Is audio heard at any of the 3 flight station speakers?
NO
YES
5 Replace VOR Receiver No. 1 (No. 2) (34-55-01).
• If fault persists, replace in order:
• VHF NAV Control Panel (34-55-02).
• VHF NAV Accessory Unit (34-55-06).
• VOR 1 (2) Preamplifier (34-55-03).
• Antenna Feed Assembly (34-55-05)
2 • Do VOR-DME station identifications disagree, or does station identification disagree with selected frequency?
NO
YES
6 Fault isolate Audio Integrating System (23-51-00)
7 Replace VOR Receiver No. 1 (No. 2) (34-55-01).
• If fault persists, replace VHF NAV Control Panel (34-55-02).
• If fault still persists, on VHF NAV control panel select the following frequencies and perform a VOR self test at each frequency: 111.1, 112.2, 114.4 and 116.6 MHz.
• If NAV flag fails to retract on one or more of above frequencies, a fault exists in the frequency control wiring (WDM 34-55-01, 02).
Refer to "2 out of 5" chart, Table 102
3 System normal

NOTE
System No. 1 shown; System No. 2 in parenthesis

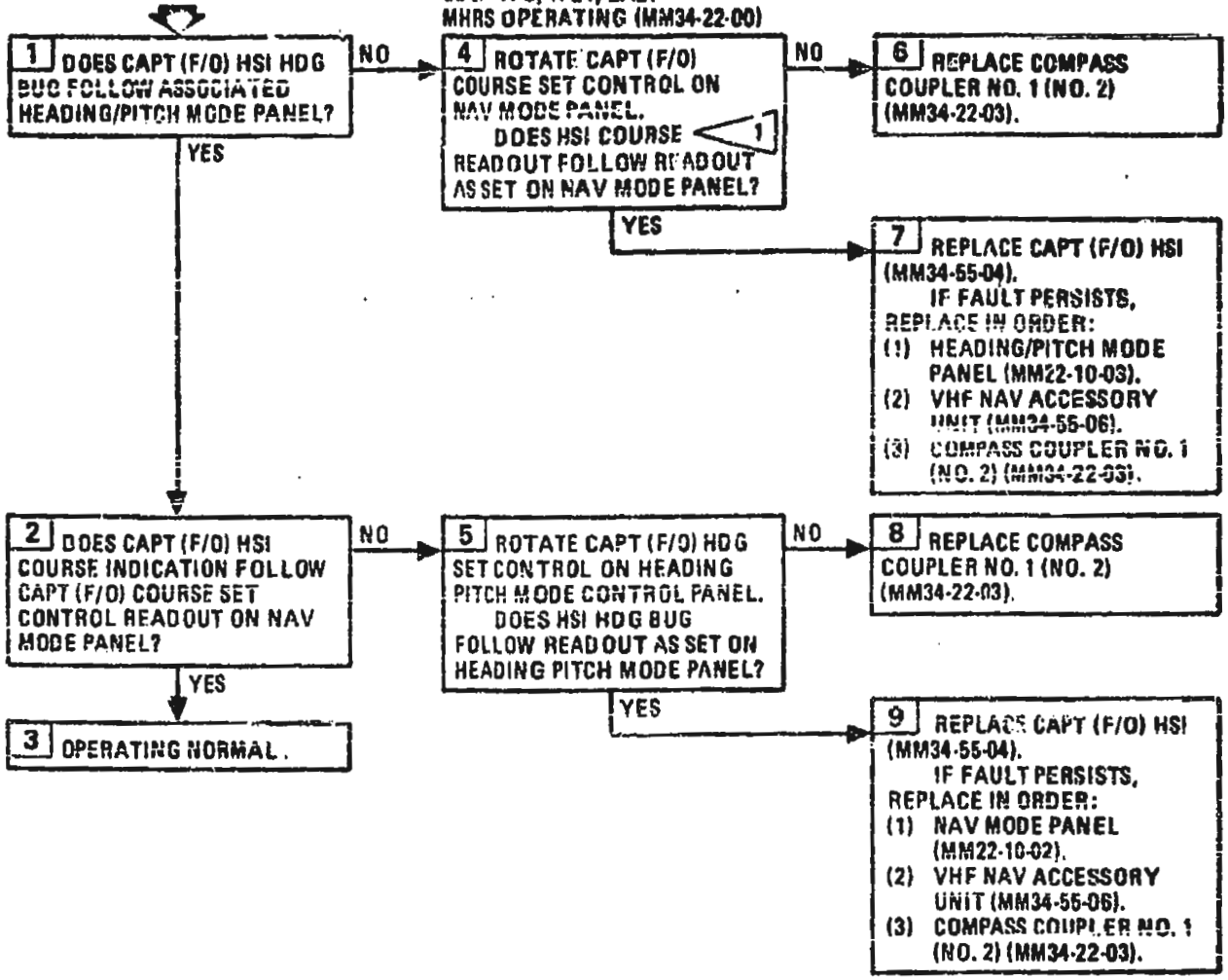
PREREQUISITES
Elec Pwr (24-00-00)
Cooling (21-25-00)
CB's: 1E3, 1E20, 1F3, 1F21, 1G1, 1G2, 1G19, 1G20, 1J20, 1J22, 1K21, 1K25, 2A21
For System under test: VHF NAV control panel tuned to local VOR station. If VOR reception is not successful, substitute VOR ramp test set for VOR station, TIC-30A, or equivalent.
On audio selector panel depress VOR for system under test. Set speaker switch on. Set volume to mid-range.
All Instrument Source Select switchlights on both panels released

M1-45902-34-1226

VOR Audio or Frequency Select Problem
Figure 105

COURSE/HEADING SET PROBLEMS

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB's: 1F3, 1F21, 2A21
MHRS OPERATING (MM34-22-00)

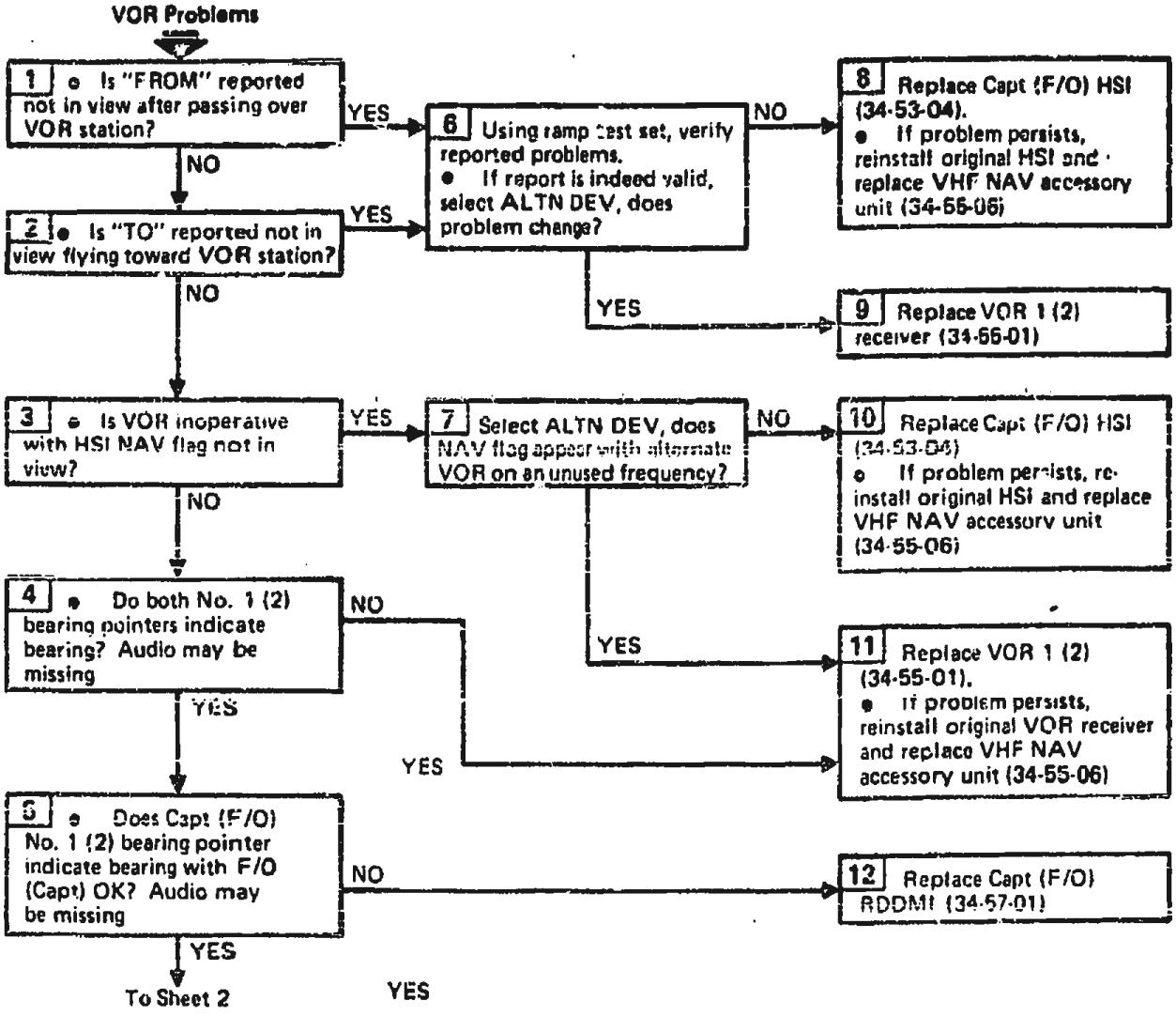

1 DOES CAPT (F/O) HSI HDG BUG FOLLOW ASSOCIATED HEADING/PITCH MODE PANEL?
NO
YES
4 ROTATE CAPT (F/O) COURSE SET CONTROL ON NAV MODE PANEL. DOES HSI COURSE READOUT FOLLOW READOUT AS SET ON NAV MODE PANEL?
1
NO
YES
6 REPLACE COMPASS COUPLER NO. 1 (NO. 2) (MM34-22-03).
7 REPLACE CAPT (F/O) HSI (MM34-55-04). IF FAULT PERSISTS, REPLACE IN ORDER: (1) HEADING/PITCH MODE PANEL (MM22-10-03). (2) VHF NAV ACCESSORY UNIT (MM34-55-06). (3) COMPASS COUPLER NO. 1 (NO. 2) (MM34-22-03).
2 DOES CAPT (F/O) HSI COURSE INDICATION FOLLOW CAPT (F/O) COURSE SET CONTROL READOUT ON NAV MODE PANEL?
NO
YES
3 OPERATING NORMAL.
5 ROTATE CAPT (F/O) HDG SET CONTROL ON HEADING PITCH MODE CONTROL PANEL. DOES HSI HDG BUG FOLLOW READOUT AS SET ON HEADING PITCH MODE PANEL?
NO
YES
8 REPLACE COMPASS COUPLER NO. 1 (NO. 2) (MM34-22-03).
9 REPLACE CAPT (F/O) HSI (MM34-55-04). IF FAULT PERSISTS, REPLACE IN ORDER: (1) NAV MODE PANEL (MM22-10-02). (2) VHF NAV ACCESSORY UNIT (MM34-55-06). (3) COMPASS COUPLER NO. 1 (NO. 2) (MM34-22-03).

NOTE

1 SOME HSIs HAVE ONLY A COURSE POINTER (NO DIGITAL READOUT)

M1-0000-34-130

Course/Heading Set Problem
Figure 106


VOR Problems
1 • Is "FROM" reported not in view after passing over VOR station?
YES
6 Using ramp test set, verify reported problems.
• If report is indeed valid, select ALTN DEV, does problem change?
NO
8 Replace Capt (F/O) HSI (34-53-04).
• If problem persists, reinstall original HSI and replace VHF NAV accessory unit (34-55-06)
NO
2 • Is "TO" reported not in view flying toward VOR station?
YES
NO
YES
9 Replace VOR 1 (2) receiver (34-55-01)
3 • Is VOR inoperative with HSI NAV flag not in view?
YES
7 Select ALTN DEV, does NAV flag appear with alternate VOR on an unused frequency?
NO
10 Replace Capt (F/O) HSI (34-53-04)
• If problem persists, reinstall original HSI and replace VHF NAV accessory unit (34-55-06)
NO
YES
4 • Do both No. 1 (2) bearing pointers indicate bearing? Audio may be missing
NO
YES
11 Replace VOR 1 (2) (34-55-01).
• If problem persists, reinstall original VOR receiver and replace VHF NAV accessory unit (34-55-06)
YES
5 • Does Capt (F/O) No. 1 (2) bearing pointer indicate bearing with F/O (Capt) OK? Audio may be missing
NO
12 Replace Capt (F/O) RDDMI (34-57-01)
YES
To Sheet 2
YES

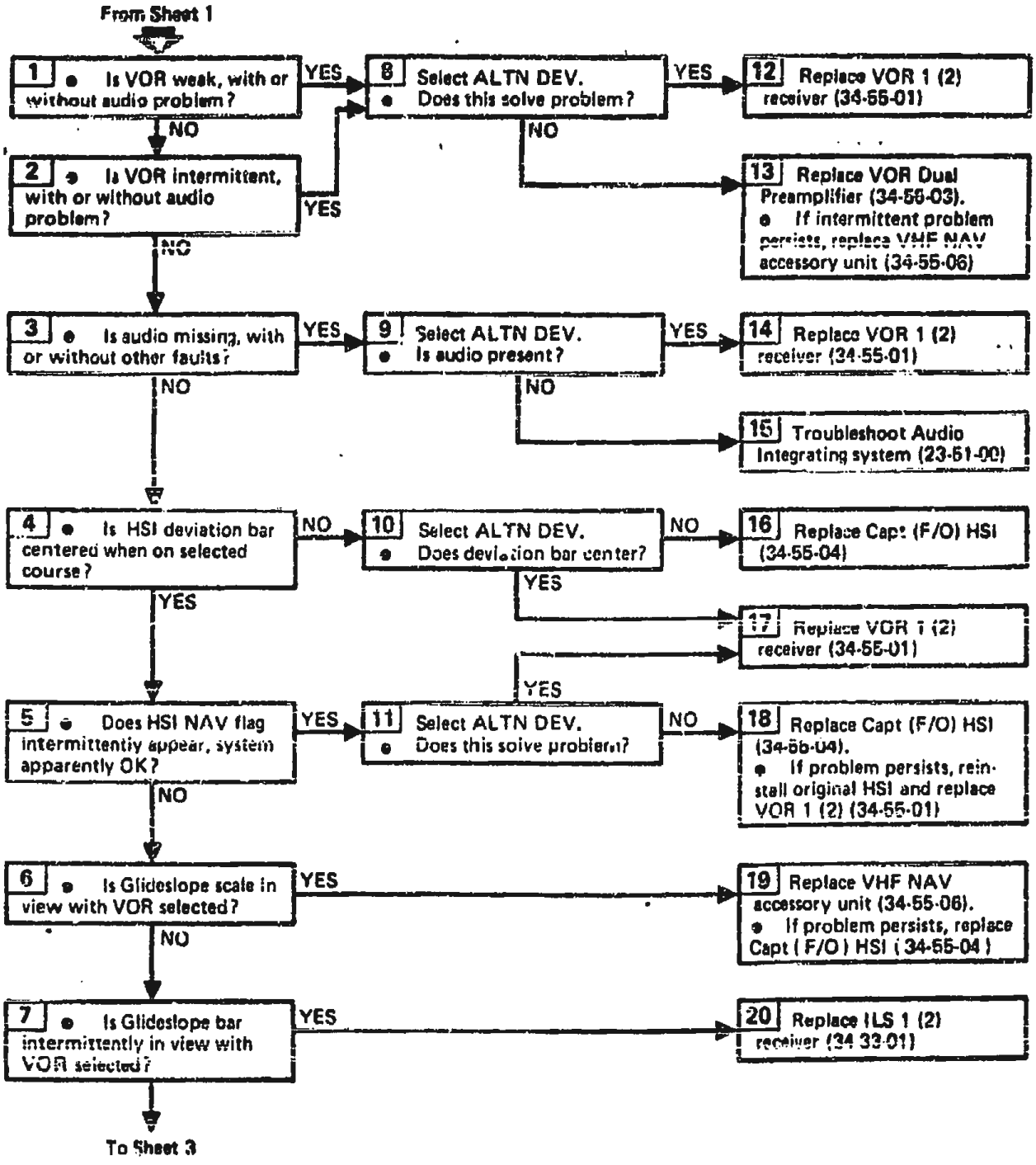
NOTE
System No. 1 shown; System No. 2 in parenthesis

PREREQUISITES
Elec Pwr (24-00-00)
Cooling (21-25-00)
CB's: 1E3, 1E20, 1F3, 1F21, 1G1, 1G2, 1G10, 1G20, 1J20, 1J22, 1K21, 1K25, 2A21

For System under test: NAV MODE panel COURSE set to 0°
T-30A if used: ON-OFF switch held on, VOR antenna extended
On audio selector panel depress VOR for system under test. Set speaker switch on. Set volume mid-range
Both RDDMI pointers set to VOR
All instrument Source Select switchlights on both panels released

M1-0002-34-2311

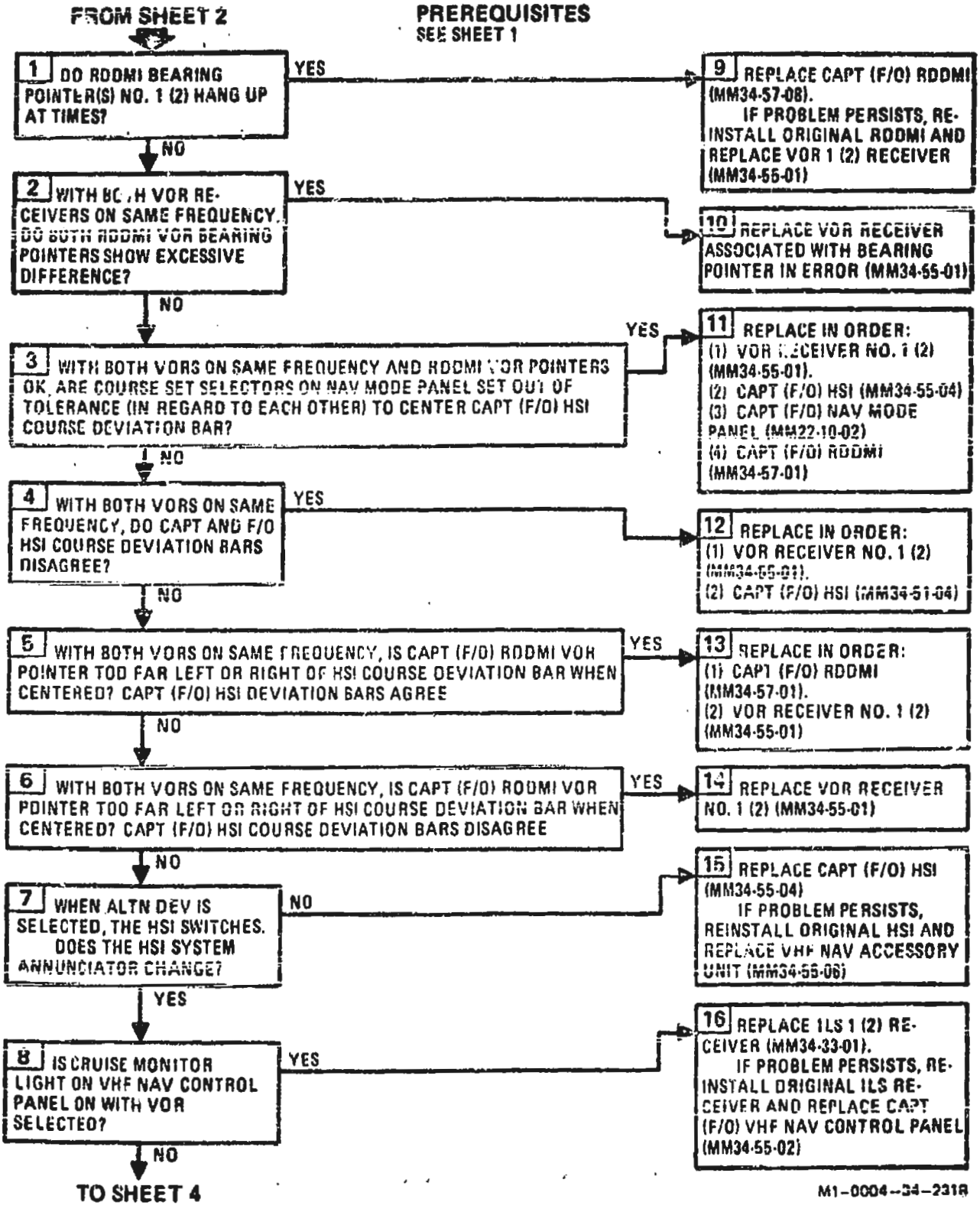
VOR Problems
Figure 107 (Sheet 1)


From Sheet 1
1 • Is VOR weak, with or without audio problem?
YES
NO
2 • Is VOR intermittent, with or without audio problem?
YES
NO
3 • Is audio missing, with or without other faults?
YES
NO
4 • Is HSI deviation bar centered when on selected course?
NO
YES
5 • Does HSI NAV flag intermittently appear, system apparently OK?
YES
NO
6 • Is Glideslope scale in view with VOR selected?
YES
NO
7 • Is Glideslope bar intermittently in view with VOR selected?
YES
To Sheet 3
8 Select ALTN DEV. • Does this solve problem?
YES
NO
9 Select ALTN DEV. • Is audio present?
YES
NO
10 Select ALTN DEV. • Does deviation bar center?
NO
YES
11 Select ALTN DEV. • Does this solve problem?
YES
NO
12 Replace VOR 1 (2) receiver (34-55-01)
13 Replace VOR Dual Preamplifier (34-55-03). • If intermittent problem persists, replace VHF NAV accessory unit (34-55-06)
14 Replace VOR 1 (2) receiver (34-55-01)
15 Troubleshoot Audio Integrating system (23-51-00)
16 Replace Capt (F/O) HSI (34-55-04)
17 Replace VOR 1 (2) receiver (34-55-01)
18 Replace Capt (F/O) HSI (34-55-04). • If problem persists, reinstall original HSI and replace VOR 1 (2) (34-55-01)
19 Replace VHF NAV accessory unit (34-55-06). • If problem persists, replace Capt (F/O) HSI (34-55-04)
20 Replace ILS 1 (2) receiver (34-33-01)

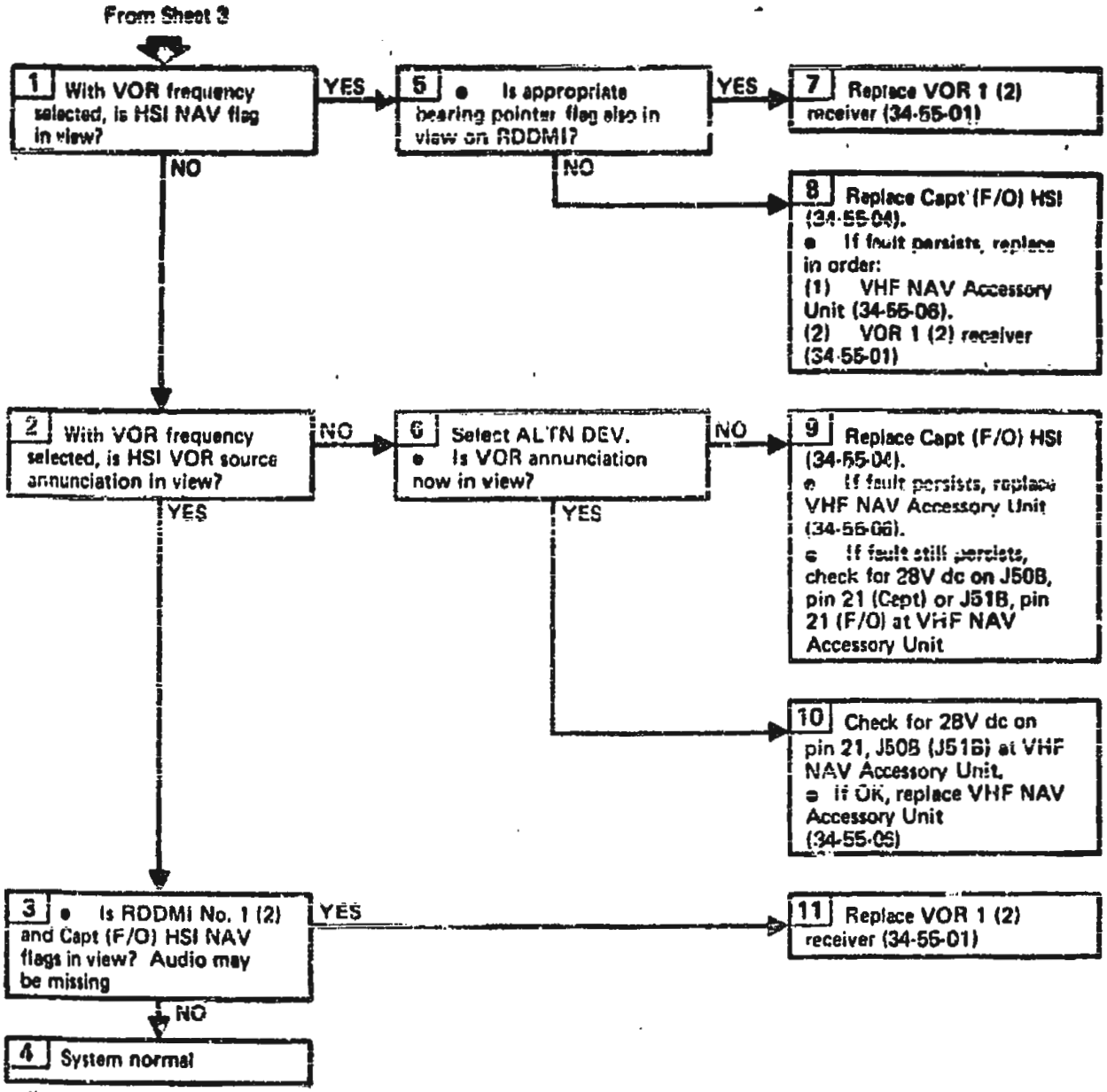
PREREQUISITES
See Sheet 1

M1-0002-34-2317

VOR Problems
Figure 107 (Sheet 2)


FROM SHEET 2
PREREQUISITES
SEE SHEET 1
1 DO RDDMI BEARING POINTER(S) NO. 1 (2) HANG UP AT TIMES?
YES
9 REPLACE CAPT (F/O) RDDMI (MM34-57-08).
IF PROBLEM PERSISTS, RE-INSTALL ORIGINAL RDDMI AND REPLACE VOR 1 (2) RECEIVER (MM34-55-01)
NO
2 WITH BOTH VOR RECEIVERS ON SAME FREQUENCY, DO BOTH RDDMI VOR BEARING POINTERS SHOW EXCESSIVE DIFFERENCE?
YES
10 REPLACE VOR RECEIVER ASSOCIATED WITH BEARING POINTER IN ERROR (MM34-55-01)
NO
3 WITH BOTH VORS ON SAME FREQUENCY AND RDDMI VOR POINTERS OK, ARE COURSE SET SELECTORS ON NAV MODE PANEL SET OUT OF TOLERANCE (IN REGARD TO EACH OTHER) TO CENTER CAPT (F/O) HSI COURSE DEVIATION BAR?
YES
11 REPLACE IN ORDER:
(1) VOR RECEIVER NO. 1 (2) (MM34-55-01).
(2) CAPT (F/O) HSI (MM34-55-04)
(3) CAPT (F/O) NAV MODE PANEL (MM22-10-02)
(4) CAPT (F/O) RDDMI (MM34-57-01)
NO
4 WITH BOTH VORS ON SAME FREQUENCY, DO CAPT AND F/O HSI COURSE DEVIATION BARS DISAGREE?
YES
12 REPLACE IN ORDER:
(1) VOR RECEIVER NO. 1 (2) (MM34-55-01).
(2) CAPT (F/O) HSI (MM34-51-04)
NO
5 WITH BOTH VORS ON SAME FREQUENCY, IS CAPT (F/O) RDDMI VOR POINTER TOO FAR LEFT OR RIGHT OF HSI COURSE DEVIATION BAR WHEN CENTERED? CAPT (F/O) HSI DEVIATION BARS AGREE
YES
13 REPLACE IN ORDER:
(1) CAPT (F/O) RDDMI (MM34-57-01).
(2) VOR RECEIVER NO. 1 (2) (MM34-55-01)
NO
6 WITH BOTH VORS ON SAME FREQUENCY, IS CAPT (F/O) RDDMI VOR POINTER TOO FAR LEFT OR RIGHT OF HSI COURSE DEVIATION BAR WHEN CENTERED? CAPT (F/O) HSI COURSE DEVIATION BARS DISAGREE
YES
14 REPLACE VOR RECEIVER NO. 1 (2) (MM34-55-01)
NO
7 WHEN ALTN DEV IS SELECTED, THE HSI SWITCHES. DOES THE HSI SYSTEM ANNUNCIATOR CHANGE?
NO
15 REPLACE CAPT (F/O) HSI (MM34-55-04)
IF PROBLEM PERSISTS, REINSTALL ORIGINAL HSI AND REPLACE VHF NAV ACCESSORY UNIT (MM34-55-06)
YES
8 IS CRUISE MONITOR LIGHT ON VHF NAV CONTROL PANEL ON WITH VOR SELECTED?
YES
16 REPLACE ILS 1 (2) RECEIVER (MM34-33-01).
IF PROBLEM PERSISTS, REINSTALL ORIGINAL ILS RECEIVER AND REPLACE CAPT (F/O) VHF NAV CONTROL PANEL (MM34-55-02)
NO
TO SHEET 4
M1-0004--34-2318

VOR Problems
Figure 107 (Sheet 3)

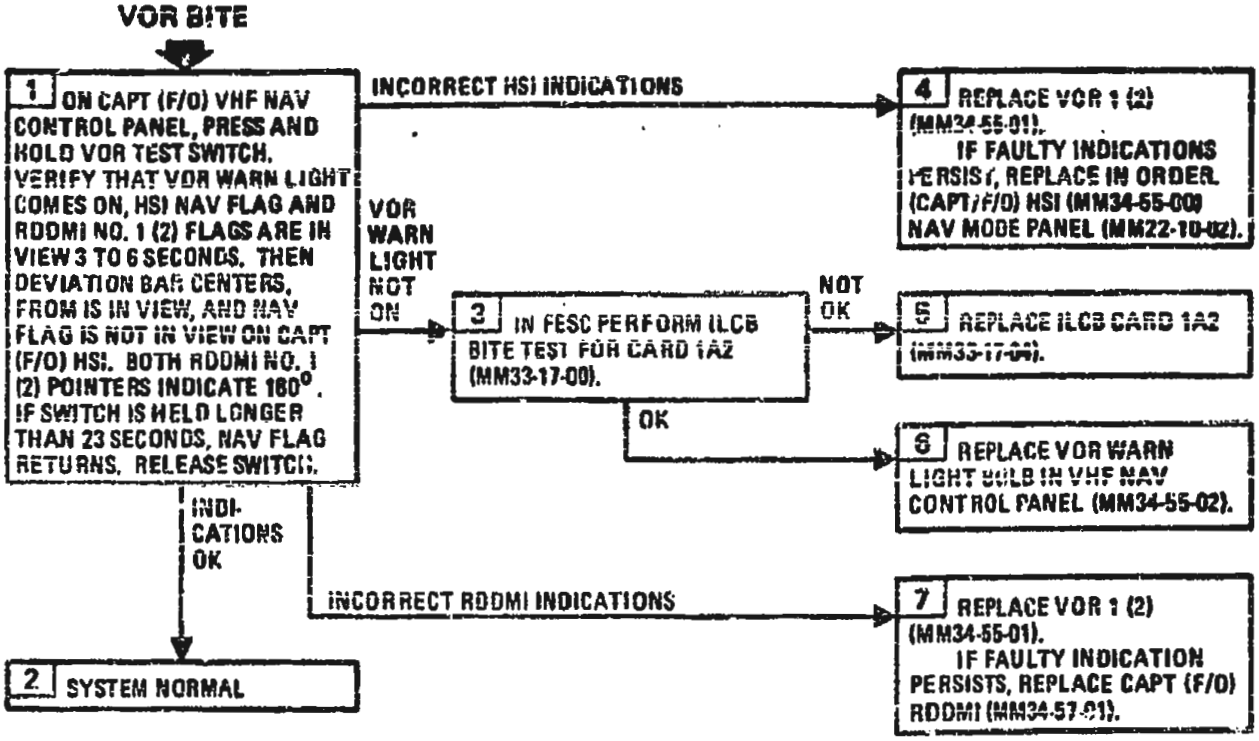

From Sheet 3
1 With VOR frequency selected, is HSI NAV flag in view?
YES
5 • Is appropriate bearing pointer flag also in view on RDDMI?
YES
7 Replace VOR 1 (2) receiver (34-55-01)
NO
8 Replace Capt (F/O) HSI (34-55-04).
• If fault persists, replace in order:
(1) VHF NAV Accessory Unit (34-55-06).
(2) VOR 1 (2) receiver (34-55-01)
2 With VOR frequency selected, is HSI VOR source annunciation in view?
NO
6 Select ALTN DEV.
• Is VOR annunciation now in view?
NO
9 Replace Capt (F/O) HSI (34-55-04).
• If fault persists, replace VHF NAV Accessory Unit (34-55-06).
• If fault still persists, check for 28V dc on J50B, pin 21 (Capt) or J51B, pin 21 (F/O) at VHF NAV Accessory Unit
YES
YES
10 Check for 28V dc on pin 21, J50B (J51B) at VHF NAV Accessory Unit.
• If OK, replace VHF NAV Accessory Unit (34-55-06)
3 • Is RDDMI No. 1 (2) and Capt (F/O) HSI NAV flags in view? Audio may be missing
YES
11 Replace VOR 1 (2) receiver (34-55-01)
NO
4 System normal

PREREQUISITES
See Sheet 1

M1-67500-34-385

VOR Problems
Figure 107 (Sheet 4)

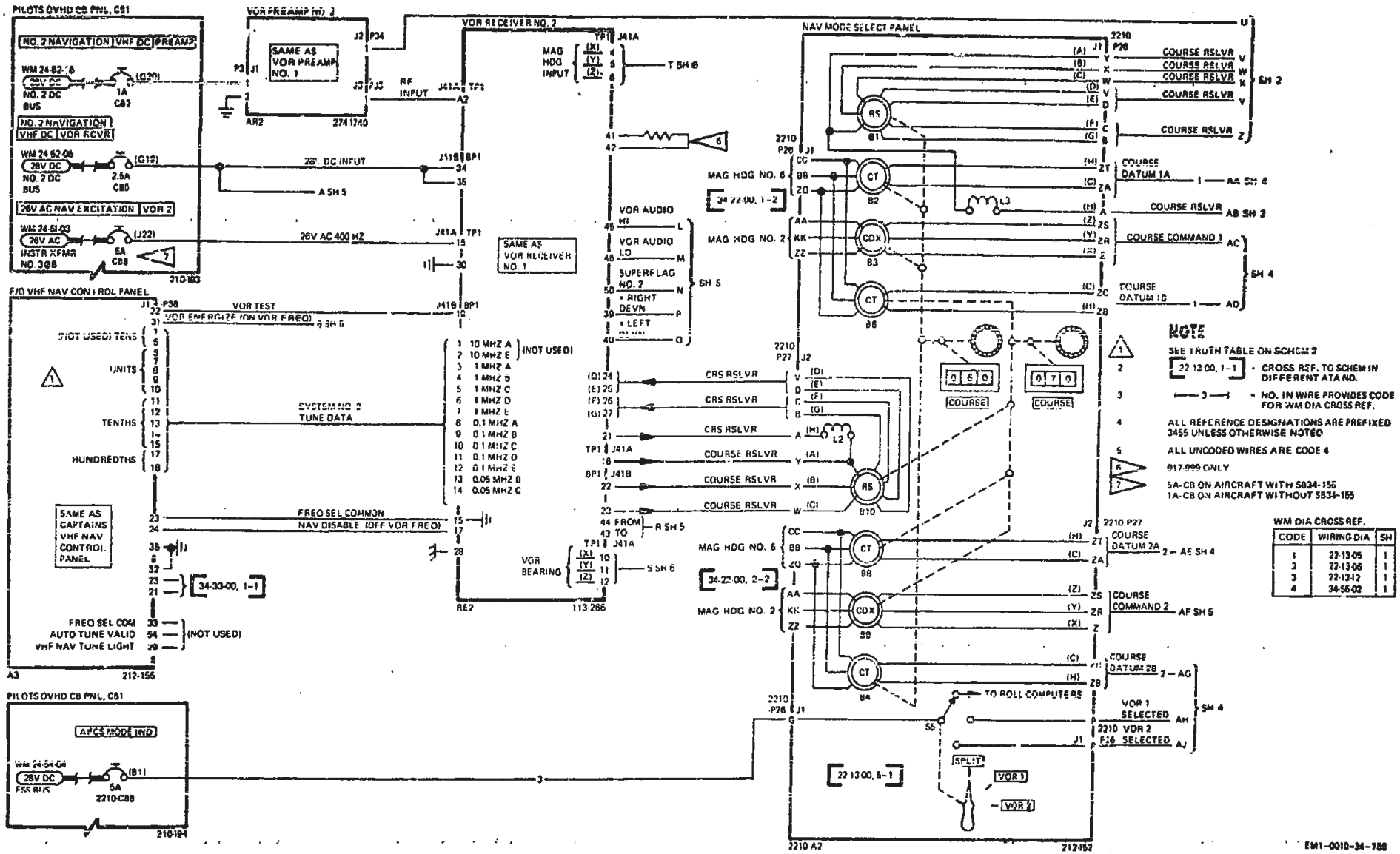
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
COOLING (MM21-25-00)
CB's: 1E3, 1E20, 1F3, 1F21, 1G1, 1G2, 1G18, 1G20, 1J20, 1J22, 1K21, 1K25, 2A21
FOR SYSTEM UNDER TEST: NAV MODE PANEL COURSE SET TO 0° AND HSI COMPASS CARD SLEWED TO 0° HEADING
BOTH RDDMI POINTERS SET TO VOR
ALL INSTRUMENT SOURCE SELECT SWITCHLIGHTS ON BOTH PANELS RELEASED


VOR BITE
1 ON CAPT (F/O) VHF NAV CONTROL PANEL, PRESS AND HOLD VOR TEST SWITCH. VERIFY THAT VOR WARN LIGHT COMES ON, HSI NAV FLAG AND RDDMI NO. 1 (2) FLAGS ARE IN VIEW 3 TO 6 SECONDS. THEN DEVIATION BAR CENTERS, FROM IS IN VIEW, AND NAV FLAG IS NOT IN VIEW ON CAPT (F/O) HSI. BOTH RDDMI NO. 1 (2) POINTERS INDICATE 180°. IF SWITCH IS HELD LONGER THAN 23 SECONDS, NAV FLAG RETURNS. RELEASE SWITCH.
INCORRECT HSI INDICATIONS
4 REPLACE VOR 1 (2) (MM34-55-01). IF FAULTY INDICATIONS PERSISTS, REPLACE IN ORDER (CAPT/F/O) HSI (MM34-55-00) NAV MODE PANEL (MM22-10-02).
VOR WARN LIGHT NOT ON
3 IN FESC PERFORM ILCB BITE TEST FOR CARD 1A2 (MM33-17-00).
NOT OK
5 REPLACE ILCB CARD 1A2 (MM33-17-00).
OK
6 REPLACE VOR WARN LIGHT BULB IN VHF NAV CONTROL PANEL (MM34-55-02).
INDI-CATIONS OK
INCORRECT RDDMI INDICATIONS
7 REPLACE VOR 1 (2) (MM34-55-01). IF FAULTY INDICATION PERSISTS, REPLACE CAPT (F/O) RDDMI (MM34-57-01).
2 SYSTEM NORMAL

NOTE
1 SYSTEM NO. 1 SHOWN; SYSTEM NO. 2 IN PARENTHESIS

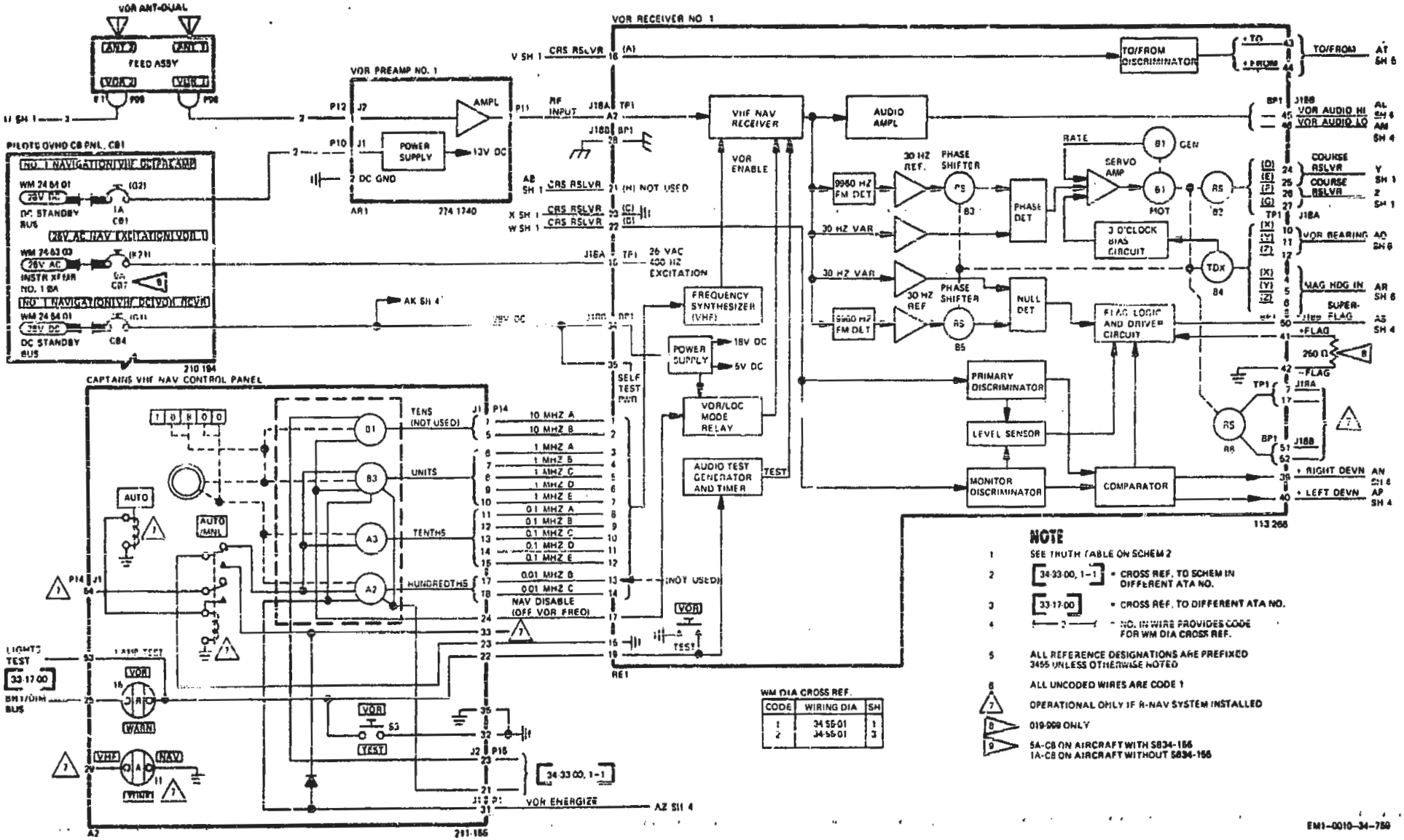
M1-276C1-34-1246

VOR BITE Test
Figure 108



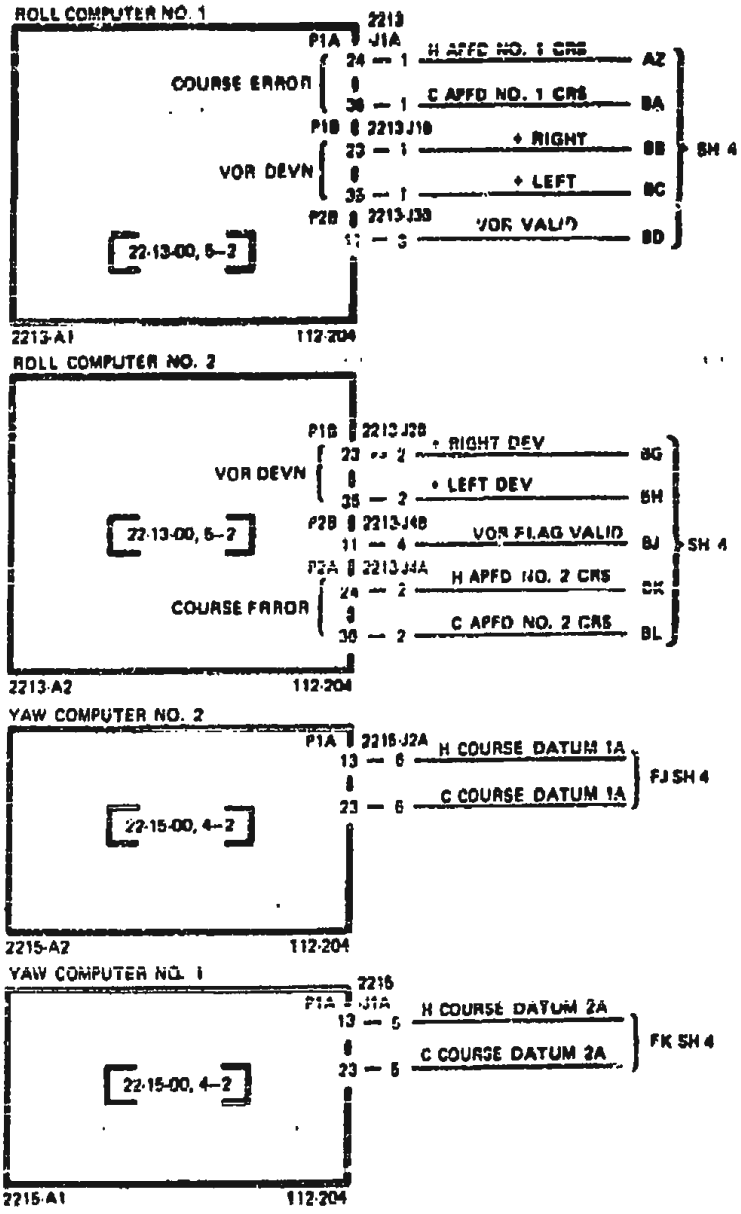
VOR No. 2 Schematic (VOR-2 and NAV Mode Pnl)
SCHEM 1 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



VOR No. 1 Schematic
SCHEM 1 (Sheet 2)

R
R
001B EFFECTIVITY: ALL



NOTE

1 [22-13-00, 1-1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

2 —— 2 —— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

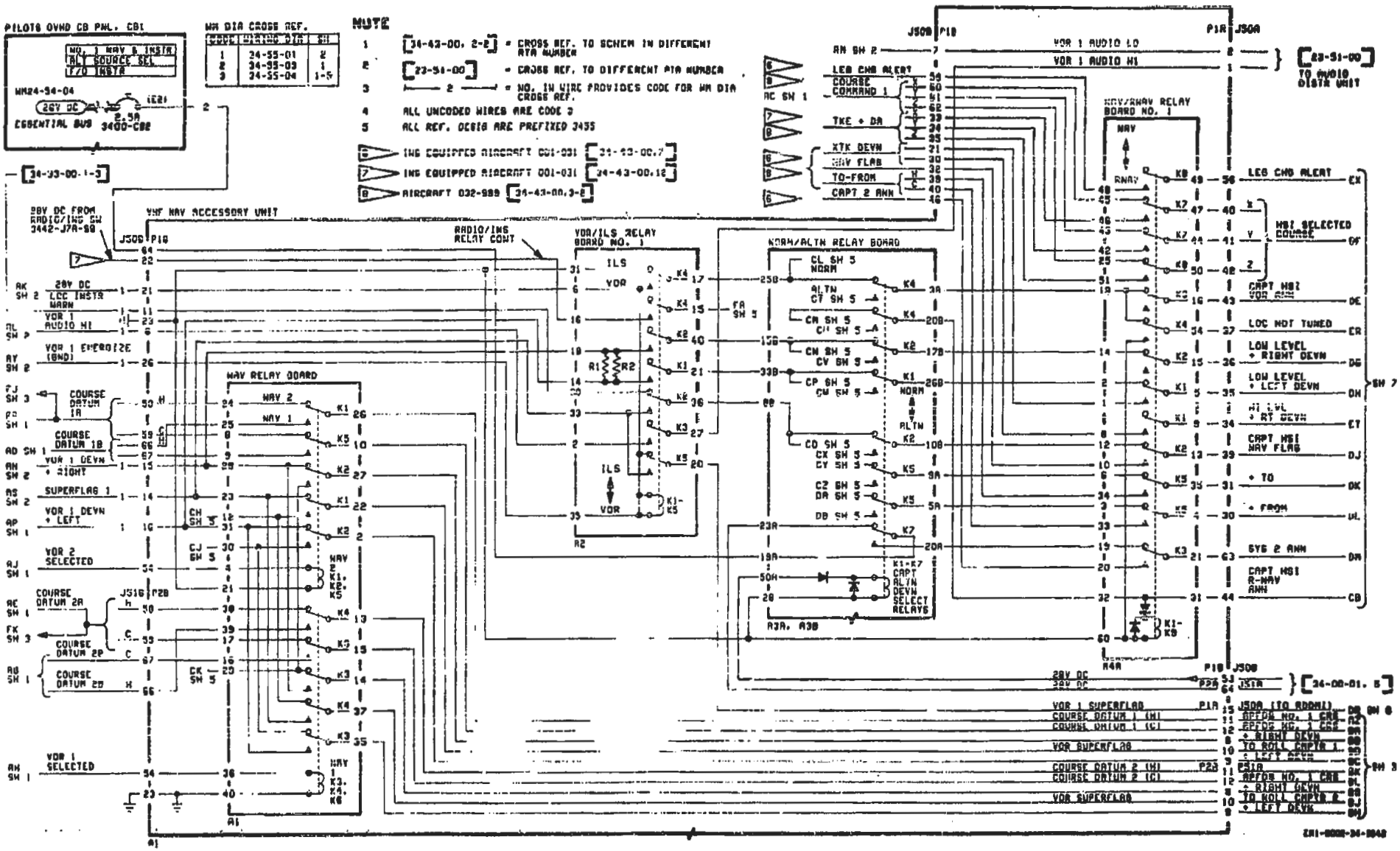
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-13-06	2
2	22-13-09	2
3	22-13-11	2
4	22-13-12	2
5	22-15-07	2
6	22-15-08	2

EM1-0000-34-2607

VOR System Schematic (AFCS Interface)
SCHEM 1 (Sheet 3)

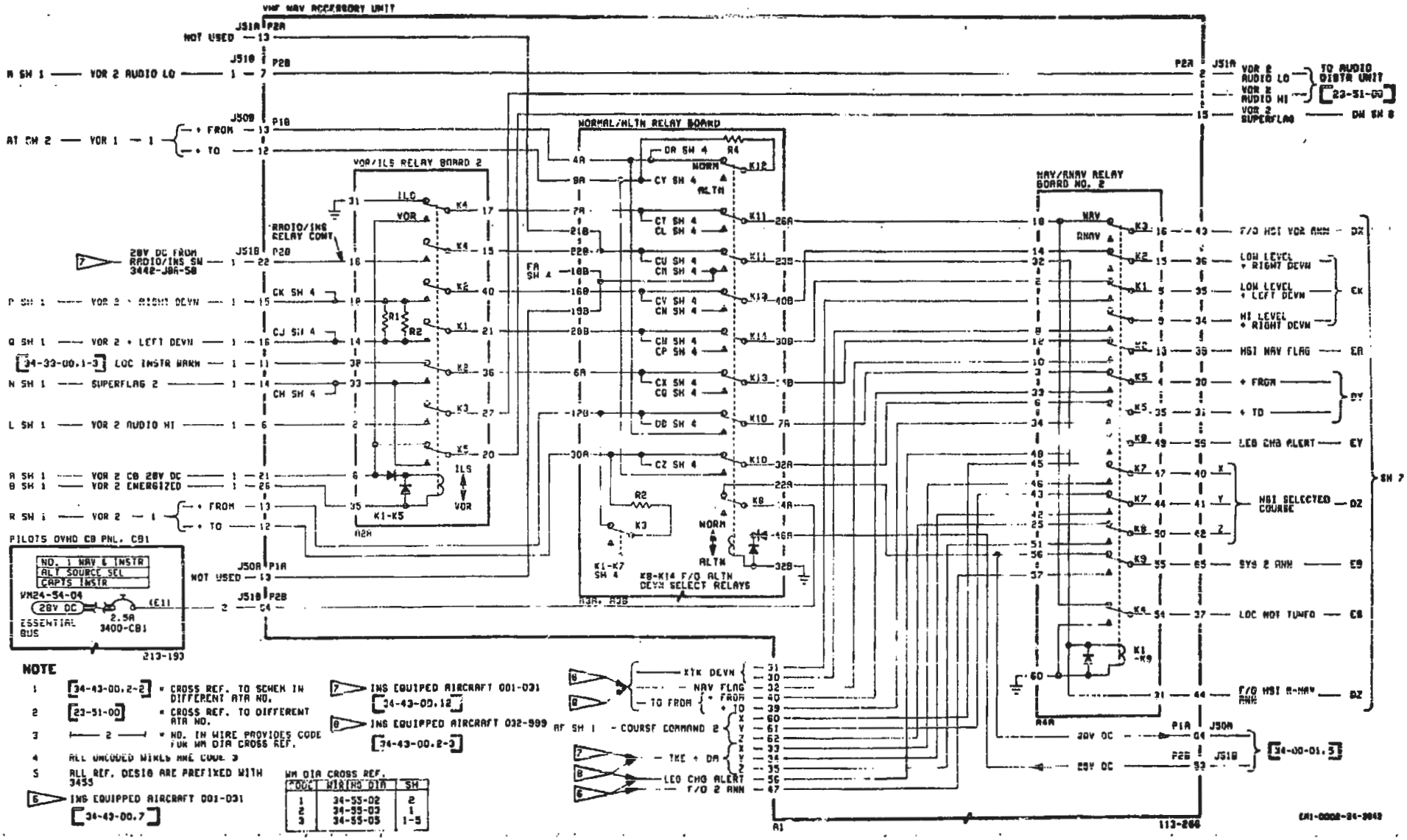
R EFFECTIVITY: ALL
R
001B



VOR System Schematic (Capt VHF NAV Access Unit)
SCHEM 1 (Sheet 4)

EFFECTIVITY: ALL

001B



NOTE

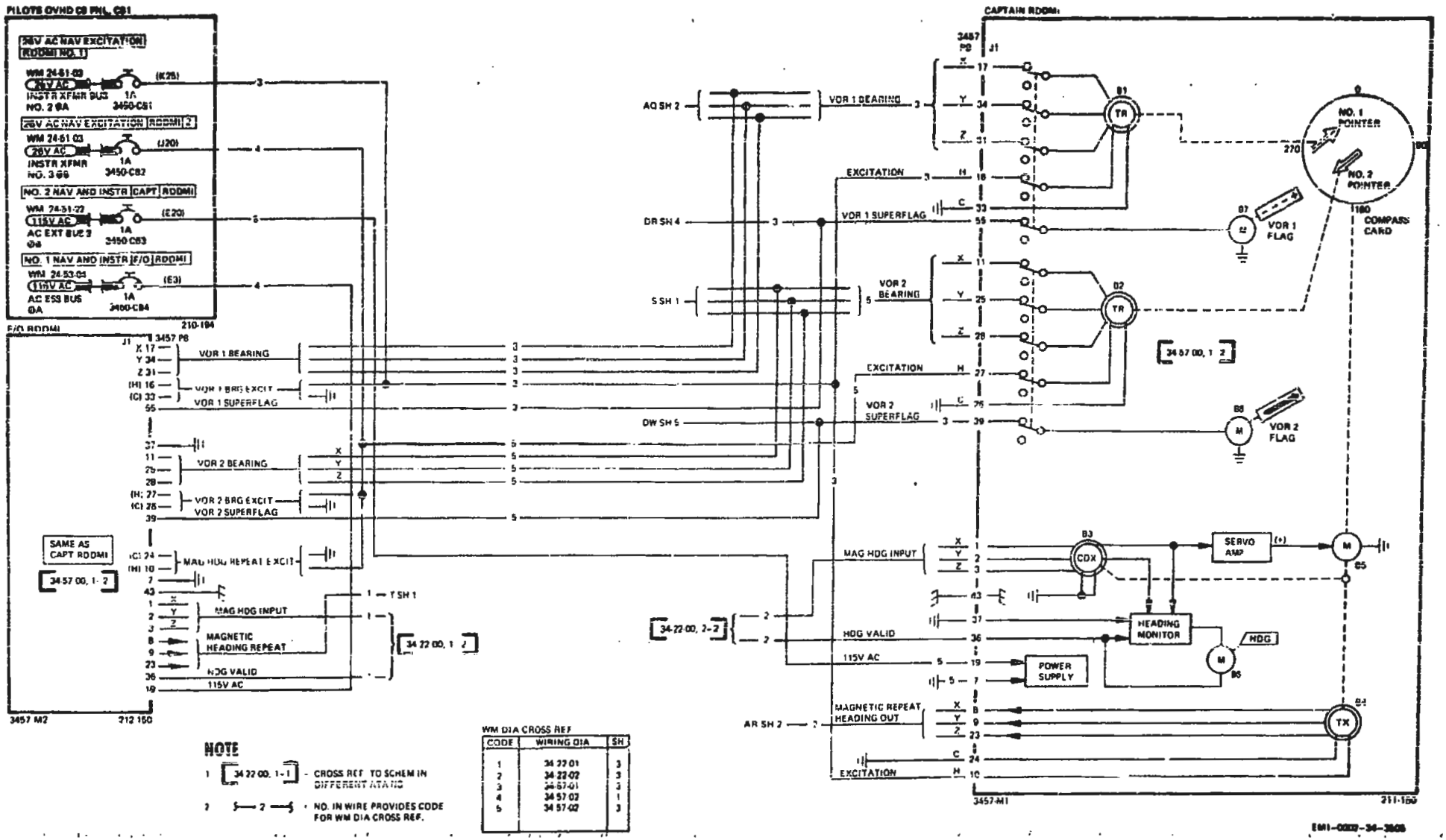
1. 34-43-00.2-2 — CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. 23-51-00 — CROSS REF. TO DIFFERENT ATA NO.
3. — 2 — NO. IN WIRE PROVIDES CODE FOR WR DIA CROSS REF.
4. ALL UNCODED WIRES ARE CODE 3
5. ALL REF. DESIG ARE PREFIXED WITH 3455
6. INS EQUIPPED AIRCRAFT 001-031 — 34-43-00.7
7. INS EQUIPPED AIRCRAFT 001-031 — 34-43-00.12
8. INS EQUIPPED AIRCRAFT 032-999 — 34-43-00.2-3

WR DIA CROSS REF.

CODE	WIRING DIA	SH
1	34-55-02	2
2	34-55-03	1
3	34-55-05	1-5

C VOR System Schematic (F/O VHF NAV Access Unit)
C SCHEM 1 (Sheet 5)

R EFFECTIVITY: ALL
R
001B



NOTE

1 [34-22-00, 1-1] - CROSS REF TO SCHEM IN DIFFERENT ATA NO

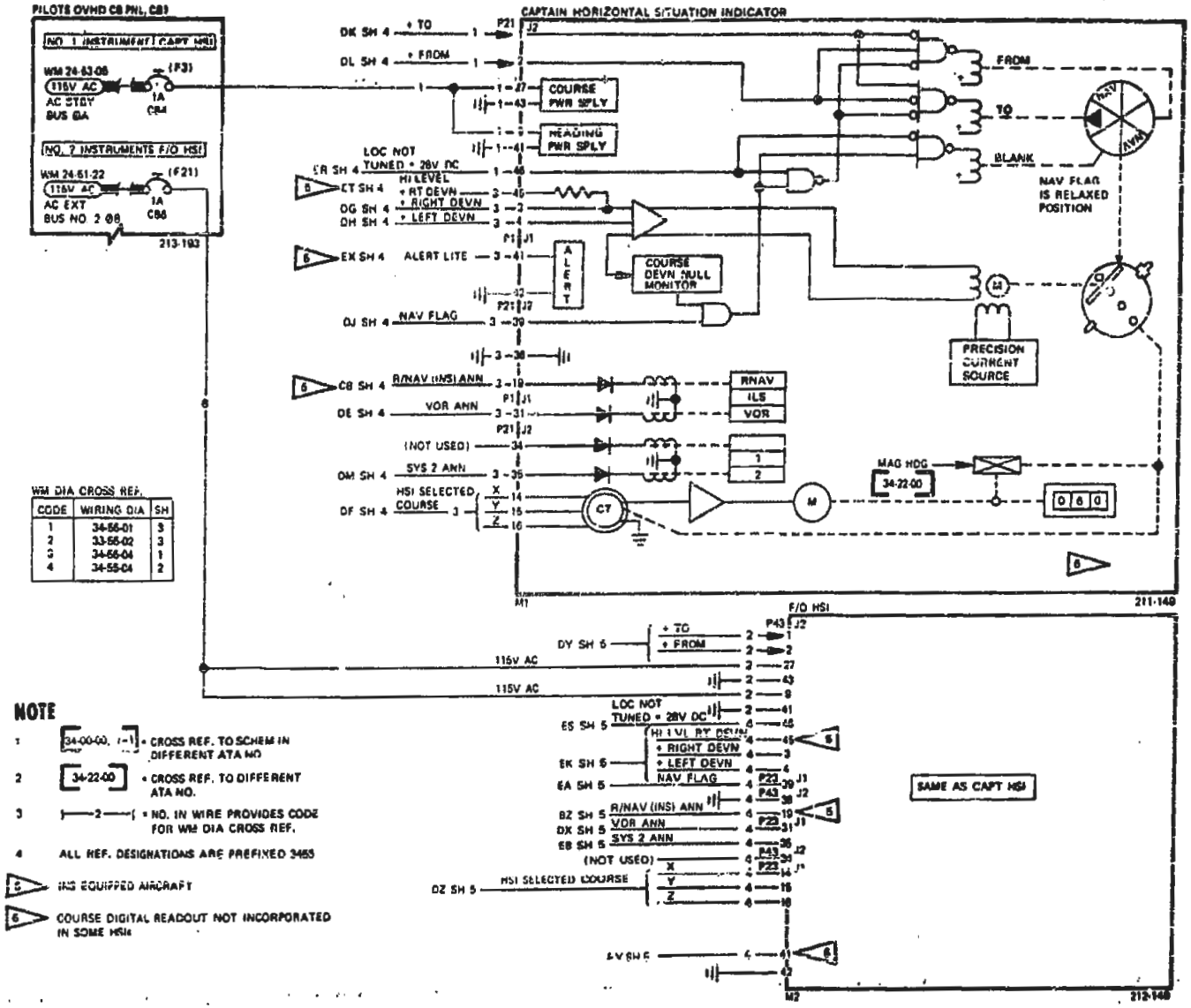
2 —2— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

WM DIA CROSS REF

CODE	WIRING DIA	SH
1	34-22-01	3
2	34-22-02	3
3	34-57-01	3
4	34-57-03	1
5	34-57-02	3

VOR System Schematic (RDDMI)
SCHEM 1 (Sheet 6)

R EFFECTIVITY: ALL
R
001B



WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	34-55-01	3
2	33-55-02	3
3	34-55-04	1
4	34-55-04	2

NOTE

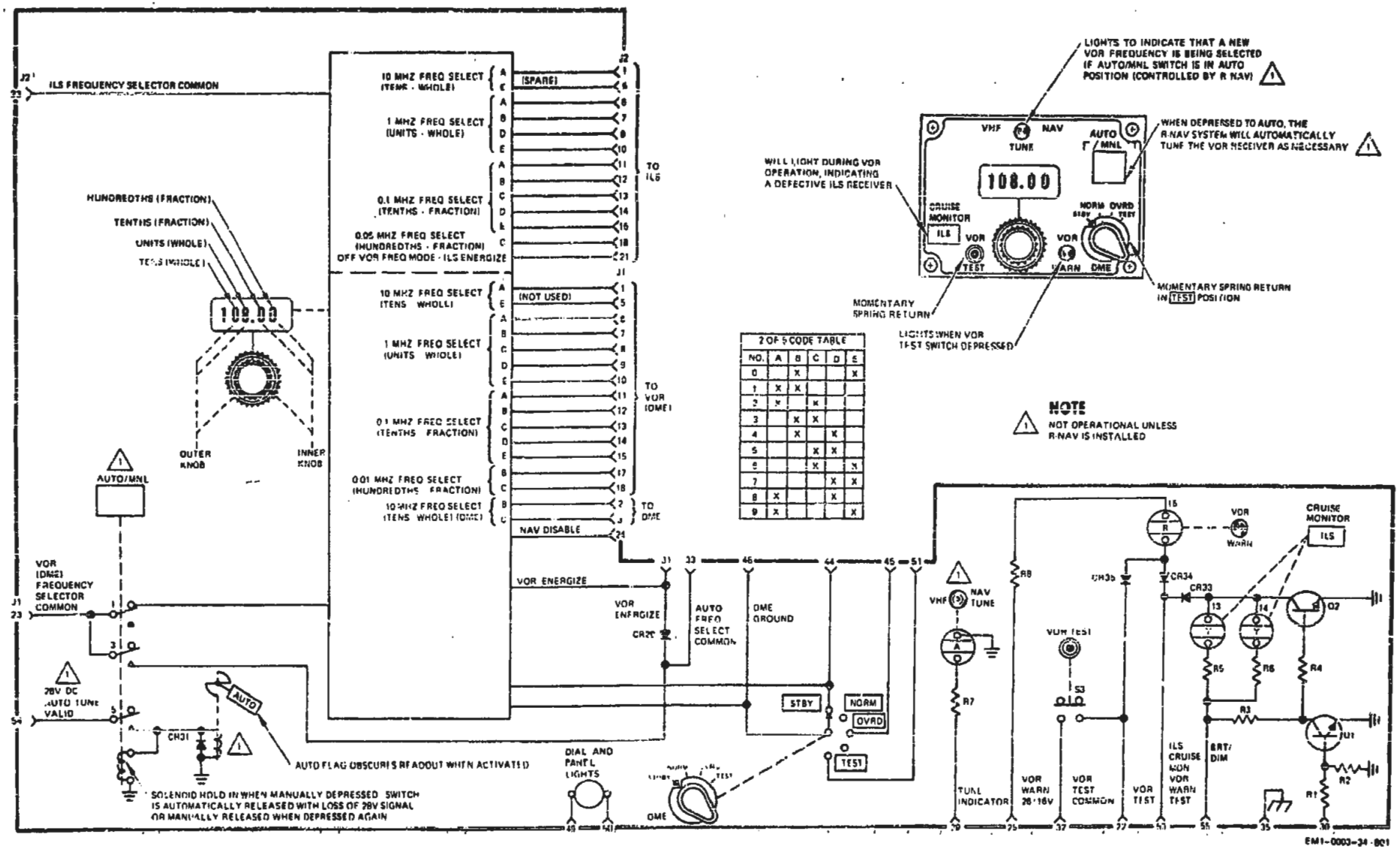
1. [34-00-00, -1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO
2. [34-22-00] = CROSS REF. TO DIFFERENT ATA NO.
3.)—2—(= NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4. ALL REF. DESIGNATIONS ARE PREFIXED 3455

5 = INS EQUIPPED AIRCRAFT

6 = COURSE DIGITAL READOUT NOT INCORPORATED IN SOME HSIs

VOR System Schematic (HSI)
SCHEM 1 (Sheet 7)

EFFECTIVITY: ALL



VHF NAV Control Panel Schematic
SCHEM 2

R 001B 33

EFFECTIVITY: ALL

VOR SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

Ramp Test Set, TIC T-30, or equivalent

C NOTE: A local VOR test station may be used for a test signal source. If test station is used, delete Paragraph 3C(1). If not available, proper function may be assured by use of BITE (paragraph 5B), provided the antenna system is not suspected as malfunctioning.

C NOTE: Interphone communication between a cockpit observer and the person operating the tester is required. Hand signals and other methods of communications could cause misinterpretation of test results.

R 2. Reference Procedures

R 22-10-00 Autopilot - Description and Operation

24-00-00 Electrical Power System - Maintenance Practices

3. Adjustment/Test

NOTE: Satisfactory performance of operational test (Paragraph 3C), ascertains the status of the VOR system. If more detailed testing is to be performed, procedures in the functional test (Paragraph 3B) should be performed.

C CAUTION: FOLLOWING ANY WORK PERFORMED ON VOR, LOCALIZER OF GLIDE SLOPE ANTENNA SYSTEMS, THE SYSTEM OR SYSTEMS MUST BE TESTED USING AN APPROVED RAMP TEST UNIT. USE OF SYSTEM SELF-TEST (VOR) IS PROHIBITED IN THESE INSTANCES.

A. Preparation

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

AUDIO CONTROL - CAPT & FE (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

INSTR XFMR NO. 2 (D9)

INSTR XFMR NO. 3 (D27)

F/O RDDMI (E3)

CAPT RDDMI (E20)

CAPT HSI (F3)

INSTR XFMR NO. 1 (F5)

F/O HSI (F21)

VOR RCVR (G1)

PREAMP (G2)

ILS (G4)

CMPS COUPLER (G7)

VOR RCVR (G19)

PREAMP (G20)

ILS (G22)

CMPS CPLR (G26)

CMPS CPLR-2 (J19)

RDDMI 2 (J20)

VOR-2 (J22)

CMPS CPLR-1 (K19)

VOR-1 (K21)

CMPS CPLR-1 (K24)

RDDMI NO. 1 (K25)

CAUTION: ADI, HSI, AND RDDMIs MAY BE DAMAGED IF OPERATED WITHOUT INSTRUMENT COOLING. THESE INSTRUMENTS MUST NOT BE ENERGIZED WITHOUT VERIFYING COOLING SYSTEM IS COMPLETE AND OPERATIONAL.

(2) On FE/SO overhead circuit breaker panel CB2, verify the following circuit breaker is closed:

INSTR COOLING (A21)

(3) On FE/SO aft circuit breaker panel CB3, verify the following circuit breakers are closed:

AUDIO CONT - CAPT & FE (C16)

AUDIO CONT - F/O & OBS & FESC (C17)

AUDIO CONT - FLT INTPH AMPL (C18)

(4) Turn on electrical power (Ref. 24-00-00).

(5) On FE/SO-ECS MONITOR panel, ensure AVIONIC AIR - FWD, MID, and INS COOLING LO FLO lights are out.

NOTE: VOR flags on RDDMI at 2 and 10 o'clock. VOR flag indication on HSI is formed by TO/FROM INDICATOR showing red with letters NAV or red and yellow stripes. All other RDDMI, and HSI flags should be ignored in this test.

(6) Set both HSI Compass Cards to 0°.

(7) Select a VOR frequency of 108.0 MHz on both VHF NAV panels.

(8) Switch both RDDMIs to VOR.

(9) Observe VOR flags on both HSIs.

(10) Observe both VOR flags on both RDDMIs.

(11) Switch both VHF NAV panels to an ILS frequency of 108.1 MHz.

(a) On RDDMIs, both flags must retract.

C (12) Position ramp test set outside aircraft.

C CAUTION: TESTER MUST BE PLACED AT LEAST 25 FEET FROM
C AIRCRAFT.

(13) On ramp test set, position controls as follows:

Selectors to 0° and TO

Turn on Test Set

Turn on TONE switch.

(14) If BITE is used in lieu of ramp test set, set 108.00 MHz on Captains and First Officers VHF NAV control panels located on glareshield, zone 210. Turn off ramp test set.

B. Functional Test

(1) Audio Check

R (a) If ramp test set is used,
R turn on ramp test set.

R (b) If ramp test set is used,
R on both VHF NAV control panels, select a frequency
R of 108.00 MHz if not already set.

R (b) If local VOR station is used,
R set local station frequency on Captains and First
R Officers VHF NAV control panels located on
R glareshield, zone 210.

NOTE: If local VOR station is being used in lieu of ramp test set, station audio will be heard in lieu of 1020 Hz test tone.

(c) On Captains and First Officers audio select panel located on left and right side of pilots center console, zone 210, depress and set VOR-1 volume control and SPKR control to midrange. Verify 1020 Hz test tone is heard through flight station speakers.

(d) On Captains and First Officers audio select panels, press and set VOR-2 volume control to midrange. Verify 1020 Hz test tone is heard through flight station speakers.

(e) On ramp test set, set TONE switch off.

(2) Captains HSI Course Check

(a) On NAV MODE select panel located on glareshield, set VOR selector to SPLIT, adjust left COURSE knob to center deviation bar on Captains HSI and to position "TO-FROM" arrow to indicate "TO" on both HSIs.

(b) Verify course control setting is within ±3 degrees of RDDMI pointer indication.

(c) Verify VOR system flags on Captains HSI are not in view (ignore heading flags).

(d) Verify navigation mode annunciator on both HSIs display VOR.

(e) Verify navigation source annunciator displays 1 for Captains HSI and 2 for F/Os HSI.

NOTE: If VOR selector is in 1 or 2, either autopilot or flight director must be engaged in NAV mode prior to setting VOR selector to SPLIT (Ref. 22-10-00).

(3) Captain Preamplifier Check

R NOTE: The ramp test set must be used to preform the
R Preamplifier Check, if a local VOR station is
R being used, go to Step 3B(4).

(a) On pilots overhead circuit breaker panel CB1, open and tag PREAMP (G2) circuit breaker.

(b) On Captains HSI, verify VOR system warning flags are not in view.

NOTE: If flags come into view, Test Set must be relocated to provide reliable signal.

(c) With warning flags not in view, collapse Test Set antenna until VOR system flags on HSI just come into view. (Relocate Test Set if required).

NOTE: Do not physically contact collapsed test set antenna.

(d) Close PREAMP (G2) circuit breaker and verify system warning flags return to out-of-view condition.

(4) First Officers HSI Course Check

(a) Repeat Step 3B(2) for F/O system, change Captain to F/O and F/O to Captain.

(5) First Officer Preamplifier Check

R NOTE: The ramp test set must be used to preform the
R Preamplifier Check, if a local VOR station is
R being used, go to Step 3B(6).

(a) Repeat Step 3B(3) for F/O preamp, change PREAMP (G2) circuit breaker to (G20) and Captain to F/O.

(6) Course Bearing Test

R (a) If ramp test set is used,
R fully extend antenna.

R (b) If ramp test set is used,
R on NAV MODE select panel, verify VOR selector is
R set to SPLIT, set both left and right COURSE
R select controls to bearing selected on ramp test
R set (TO 0°, 90°, 180° or 270°).

R (b) If local VOR station is used,
R on NAV MODE select panel, verify VOR selector is
R set to SPLIT, set both left and right COURSE
R select controls to bearing of local VOR station.

(c) Verify HSI course bars agree within 1.0 degree (± 1/2 pointer width).

(d) On Captain and First Officer radio digital distance magnetic indicators (RDDMI) located on Captain and First Officer instrument panels, set both VOR-ADF switches to VOR and verify both pointers agree within ±1.0 degree (±1/2 pointer width) of bearing selected on test set, or actual bearing of local VOR station.

(e) On NAV MODE select panel, adjust both COURSE knobs to increase course bearing indicators on HSIs by 10 degrees.

(f) Verify HSI course bars deflect left to second dot.

(g) Adjust both COURSE knobs to decrease course bearing indicators by 20 degrees (10 degree decrease from original starting point.

(h) Verify HSI course bars deflect right to second dot.

(i) Adjust both COURSE knobs to increase course bearing indicators in HSI to 180 ±5 degrees from RDDMI pointer reading

(j) Verity course bar returns to center.

(k) Verify TO/FROM displays indicate FROM.

(l) Set bearing selector on Test Set to 90 degrees.

(m) Verify both bearing pointers on both RDDMIs read 90 ±2 degrees.

(7) Captains ALTN Instrument Source Select Check

(a) On Captains VHF NAV control panel, select a frequency of 108.2 MHz and observe flag on Captains HSI and VOR-1 flag on both RDDMIs.

(b) Press ALTN DEV switchlight on Captain Instrument Source Select panel, observe switchlight legend comes on and both HSI read within 1.0 degree of test set bearing. Verify Captains HSI shows 2 in appropriate annunciator window. Verify Captain HSI flag is retracted and VOR flag on Capt and F/O RDDMI is in view. Press ALTN DEV switchlight on First Officers Instrument Source Select panel and observe switchlight does not light and no change occurs in HSI indications.

(c) Press Captain ALTN DEV switchlight to return to normal position. Switchlight must go out, verify First Officers ALTN DEV switchlight legend comes on and VOR flag appears on First Officer HSI.

(d) Press First Officer ALTN DEV switchlight to return to normal position.

(8) First Officers Instrument Source Select Check

(a) On Captains VHF NAV control panel, select a frequency of 108.0 MHz. On F/Os VHF NAV control panel, select a frequency of 108.2 MHz. Observe VOR flag on F/Os HSI and VOR-2 flag on both RDDMIs.

(b) Press ALTN DEV switchlight on First Officers Instrument Source Select Panel, observe switchlight legend comes on, flag is out of view on First Officer HSI and indications are within 1.0 degree of test set bearing. Verify VOR 2 flag on both RDDMIs remain in view. Verify First Officer HSI shows 1 in appropriate annunciator window.

(c) Press Captain ALTN DEV switchlight and observe switchlight does not light and no change occurs in HSI indications.

(d) Press First Officer ALTN DEV switchlight to return to normal position. Switchlight must go out, verify Captains ALTN DEV switchlight legend comes on and VOR flag appears on Captains HSI.

(e) Return F/Os VHF NAV Control panel to 108.0 and press Captains ALTN DEV switchlight to return to normal position. Verify all flags are out of

view, and HSI annunciators return to indications of Step 3B(2)(d) and (e).

(f) Turn off VOR test set.

(g) On both VHF NAV panels, select frequency of 118.05 MHz.

(h) Verify VOR flags on both RDDMIs come into view.

C. Operational Test

NOTE: Test can be performed using VOR test switch on each receiver front panel, or by using VOR TEST switch on each VHF NAV control panel. Ensure ALTN DEV and ALTN HDG switchlights on both INSTRUMENT SOURCE SELECT panels are latched out.

(1) On NAV MODE select panel, set both left and right COURSE selectors to 000 and verify VOR selector is set to SPLIT.

(2) Press VOR test switch (first system No. 1, then system No. 2). Following must occur:

VOR WARN light on applicable VHF NAV control panel comes on.

NAV flag on applicable HSI and applicable pointer flag (1 or 2) on both RDDMIs comes into view for three seconds and up to nine seconds then goes out of view.

NOTE: If test switch is held for over 14 to 20 seconds, flags will reappear.

NAV flag on applicable HSI and applicable pointer flag (1 or 2) on both RDDMIs will be out of view.

HSI deviation bar deflects momentarily, then returns to center.

HSI, "TO-FROM" indication, must indicate "FROM".

Applicable pointer (1 or 2) on both RDDMIs indicates 180 degree bearing.

Press and adjust applicable VOR (-1 or -2) volume control and SPKR control on audio selector panel(s) and check for presence of 900 Hz test tone signal through flight station speakers.

(3) Release VOR TEST switch.

D. Test Completion

R (1) Remove ramp test set (if used).

(2) Turn off electrical power (Ref. 24-00-00).

VOR RECEIVER - REMOVAL AND INSTALLATION

1. Reference Procedure

   34-55-00 VOR System - Adjustment and Test

2. Removal/Installation

   A. Removal

      CAUTION: DAMAGE TO THE VOR UNITS CAN RESULT IF THE CIRCUIT BREAKERS IN STEP A(1) ARE NOT OPENED BEFORE REMOVING UNIT.

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers for VOR receiver to be removed:

          NO. 1 NAVIGATION VHF DC VOR RCVR (G1)

          NO. 2 NAVIGATION VHF DC VOR RCVR (G19)

          26VAC NAVIGATION EXCITATION VOR 1 (K21)

          26VAC NAVIGATION EXCITATION VOR 2 (J22)

      (2) Open access door 112AB and enter forward electronic service center, zone 112. Locate two VOR receivers on shelf 2 of rear rack (Ref. Fig. 401).

      (3) Loosen and disengage knurled knobs securing VOR receiver being removed to mount.

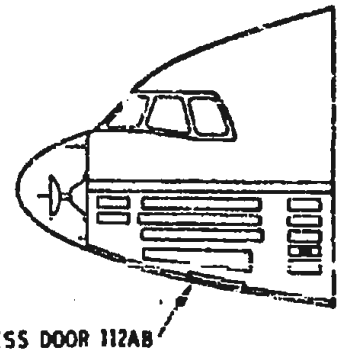
      (4) Pull VOR receiver forward until rear connectors are disengaged from mating mount connectors. Remove VOR receiver.

   B. Installation

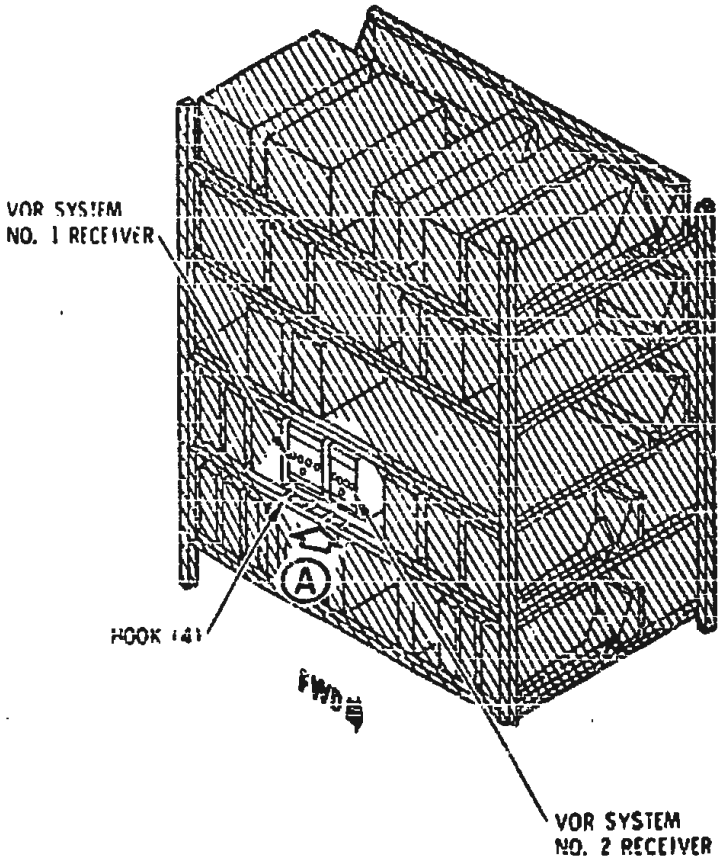
      CAUTION: DAMAGE TO THE VOR UNITS CAN RESULT IF THE CIRCUIT BREAKERS IN STEP B(1) ARE NOT OPENED BEFORE INSTALLING UNIT.

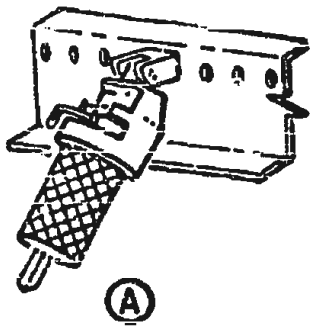
      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Position VOR receiver on mount, slide into place aligning rear connectors with mating mount connectors.



FESC REAR RACK, SHELF NO. 2





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R
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VOR Receiver - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

(3) Place mount clamps over VOR receiver hooks.

(4) Tighten knurled knobs securing VOR receiver to mount.

(5) Close and secure access door 112AB.

(6) Remove tags and close circuit breakers opened in Step A(1).

(7) Perform BITE check portion of VOR system adjustment and test procedure on system containing replaced receiver (Ref. 34-55-00).

VHF NAVIGATION CONTROL PANEL - REMOVAL AND INSTALLATION

1. Reference Procedures

34-33-00	ILS System - Adjustment and Test
34-51-00	DME System - Adjustment and Test
34-55-00	VOR System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, open and tag circuit breakers NO. 1 NAVIGATION VHF DC VOR RCVR (G1) or NO. 2 NAVIGATION VHF-DC VOR RCVR (G19).

(2) On FE/SO aft circuit breaker panel CB3, open and tag circuit breaker CTR INSTR & GLARE SHLD (J13).

(3) Locate two VHF NAVigation control panels (control panel) on glareshield (Ref. Fig. 401).

(4) Loosen Dzus fasteners securing control panel to glareshield.

(5) Pull control panel from recess in glareshield and disconnect receptacles from mating aircraft connectors. Remove control panel.

B. Installation

(1) Verify that circuit breakers opened in Steps A(1) and A(2) are open and tagged.

(2) Connect control panel receptacles to mating aircraft connectors.

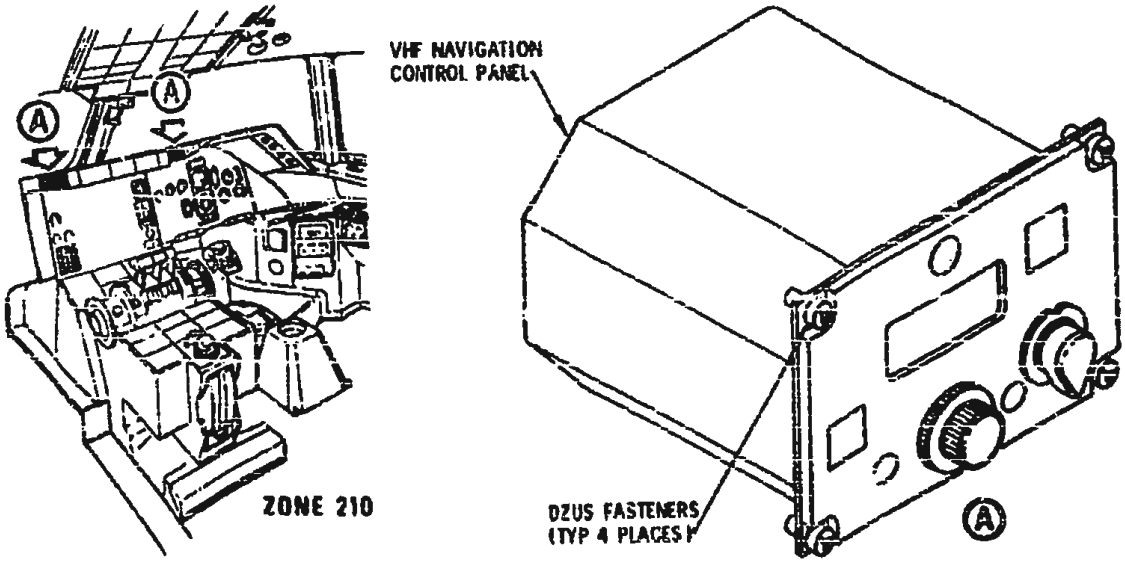
(3) Place control panel in glareshield recess and secure with Dzus fasteners.

(4) Remove tags and close circuit breakers opened in Step A(1).

CR CR (5) Perform ILS system operational test procedure (Ref. 34-33-00).

CR (6) Perform DME system operational test procedure (Ref. CR 34-51-00).

CR (7) Perform VOR system operational test procedure (Ref. CR 34-55-00).



VHF Navigation Control Panel - Removal and Installation
Figure 401

VOR PREAMPLIFIER - MAINTENANCE PRACTICES

NOTE: This Deactivation procedure applies when an aircraft is to be dispatched in accordance with the MEL.

1. General

R Both preamplifiers can be inoperative and both VOR Systems can
R still be operational provided the received VOR signal strength
R in the area is of sufficient magnitude. The VOR System warning
R flag(s) in view on the Captain and/or First Officer HSI (and
R RDDMI) may be caused by an inoperative No. 1 and/or No. 2 VOR
R preamplifier.

R 2. Deactivation

R A. No. 1 VOR System Preamplifier

R (1) On the Pilots overhead circuit breaker panel CB1, open
R and tag circuit breaker No. 1 NAVIGATION-VHF DC-PREAMP
R (G2).

R (2) Install a placard on the Captains instrument panel in a
R prominent place, VOR-1 PREAMP INOPERATIVE.

R (3) Make appropriate entry in the airplane log book.

R B. No. 2 VOR System Preamplifier

R (1) On the Pilots overhead circuit breaker panel CB1, open
R and tag circuit breaker NO. 2 NAVIGATION-VHF DC-PREAMP
R (G20).

R (2) Install a placard on the First Officers instrument
R panel in a prominent place, VOR-2 PREAMP INOPERATIVE.

R (3) Make appropriate entry in airplane log book.

R

VOR PREAMPLIFIER - REMOVAL AND INSTALLATION

1. Reference Procedure

34-55-00 VOR System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION - VHF-DC - PREAMP (G2) and NO. 2 NAVIGATION - VHF-DC - PREAMP (G20).

(2) Locate two preamplifiers (preamp) in area above ceiling - overhead trim panel in passenger cabin, at right end of aft divider, just forward of lavatories (Ref. Fig. 401).

(3) Remove two rear coax cables and one forward coax cable from connectors on preamp.

C
C
C NOTE: Carefully check both coax cable connectors for possible fracture at the crimp area underneath the heat shrinkable tubing.

(4) Remove screws securing preamp to be removed (No. 2 - top, No. 1 - bottom) at FS 1763. Remove preamp.

B. Installation

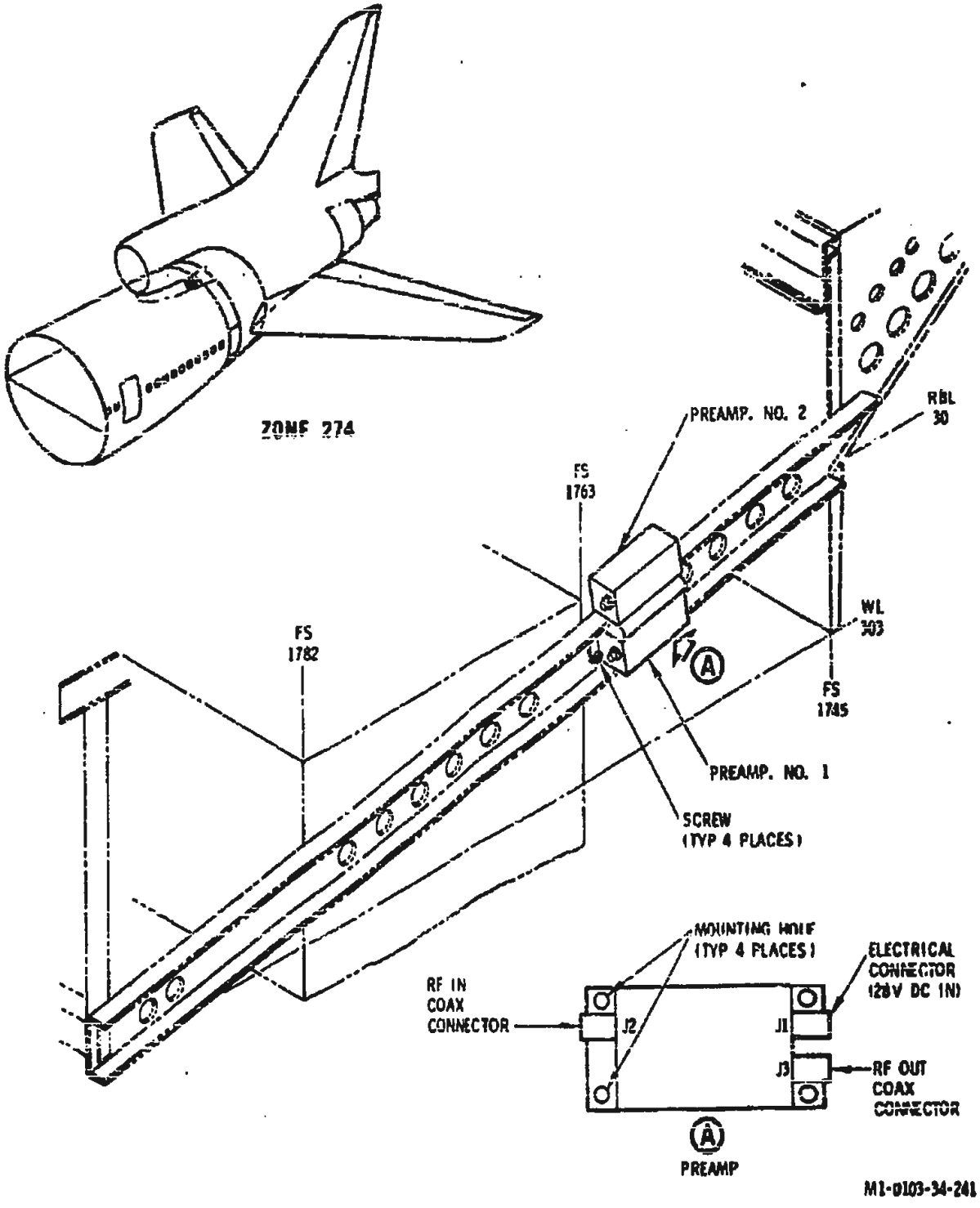
(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Install and tighten screws securing preamp.

C (3) Connect cables to preamp connectors.

(4) Remove tags and close circuit breakers opened in Step A(1).

(5) Perform preamplifier check portion of VOR system adjustment and test procedure (Ref. 34-55-00).



R VOR Preamplifier - Removal and Installation
R Figure 401

HORIZONTAL SITUATION INDICATOR (HSI) - REMOVAL AND INSTALLATION

1. Reference Procedures

24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

NOTE: The HSI has proven to be susceptible to high ambient temperatures. Therefore, it is recommended that whenever L-1011 aircraft are on the ground for one (1) hour or more, the master radio bus switches be turned off, and HSI circuit breakers be pulled under the following conditions:

R (1) The outside air temperature is above 27-degrees C.
R (80-degrees F.) and the APU and at least one air conditioning pack are operating.

R (2) The outside air temperature is above 18-degrees C.
R (65-degrees F.) and no packs are operating.

The above does not apply if systems are needed for testing or functional checking.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers CAPT HSI (F3) or F/O HSI
R (F21), and CAPT R (L21), or F/O R (L25).

R (2) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR LOCK SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF ALL PERSONNEL.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

PLACARD HYDRAULIC PANELS - DO NOT TURN OFF.

(3) Pressurize a hydraulic power system (Ref. 29-11-00).

(4) Pull control column full aft and tie to seat or other structure.

(5) Locate Captains HSI on Captains instrument panel, zone 211, or First Officers HSI on First Officers instrument panel, zone 212 (Ref. Fig. 401).

(6) Loosen clamp screws securing HSI to Captains or First Officers instrument panel.

(7) Pull HSI out of recess in Captains or First Officers instrument panel and disconnect connectors from receptacles. Remove HSI.

B. Installation

R (1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) On FE/SO overhead circuit breaker panel CB2, zone 215, verify INSTR COOLING (A21) circuit breaker is closed.

(3) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR LOCK SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF ALL PERSONNEL.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

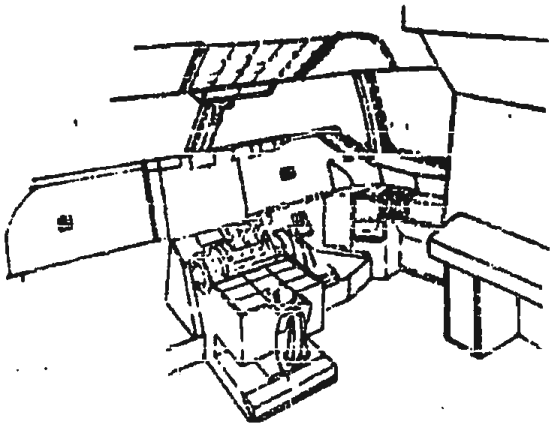
PLACARD HYDRAULIC PANEL - DO NOT TURN OFF.

(4) Pressurize a hydraulic system (Ref. 29-11-00) and placard hydraulic panel.

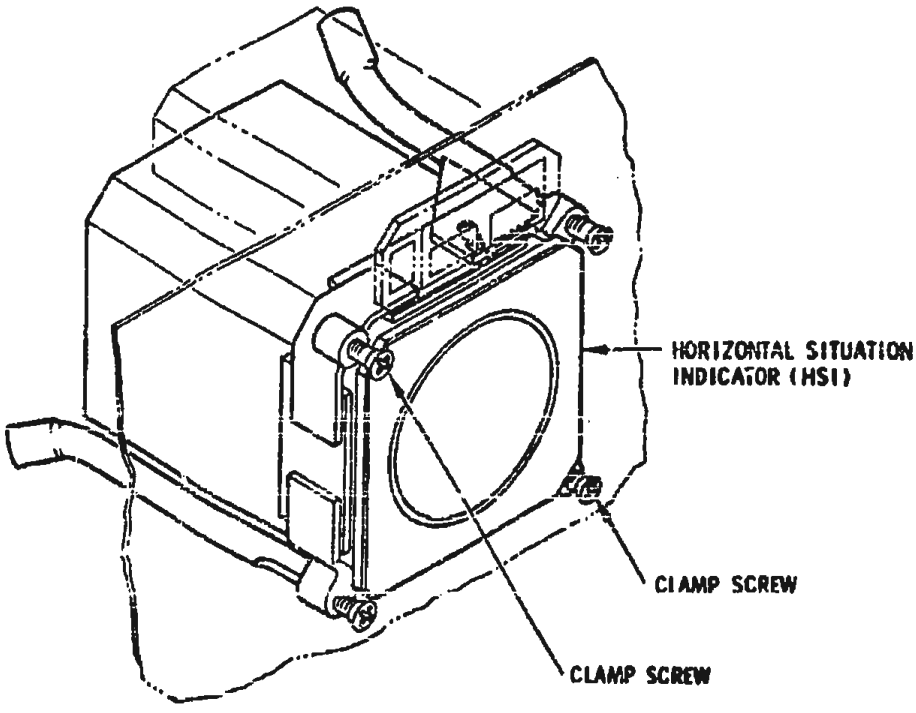
(5) Reach through instrument panel opening and feel for air flow from instrument cooling system.

Air flow is from tubes at upper right and lower left corners of instrument clamp behind panel.

(6) Pull control column full aft and tie to seat or other structure.



FLIGHT STATION
ZONE 211



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R Horizontal Situation Indicator (HSI)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

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(7) Connect electrical connectors to HSI receptacles.

(8) Place HSI in recess of Captains or First Officers instrument panel and secure by tightening clamp adjusting screws to 5-8 lb-in.

(9) Untie control column.

(10) Remove tags and close circuit breakers opened in Step 2A(1).

C 3. Post Installation Test (Aircraft Without INS)

C NOTE: In addition to the test covered in this procedure, INS
C equipped airplanes require test in paragraph 4 of this
C procedure.

A. Glideslope - Localizer Pointer Test

R NOTE: Equipment required for Step 3A: Ramp Test Set, TIC
R T-30A, or equivalent.

(1) On pilots overhead circuit breaker panel CB1, close circuit breakers ILS (G4) or ILS (G22).

(2) On Captain or F/O VHF NAV control panel, select 108.1.

(3) Set up TIC-30A Test Set. If equivalent test set is used, follow instructions provided.

(4) Extend LOC and GS antennas. Set and hold on, LOC and GS switches.

(5) On APFDS ENGAGE panel, set FD "A" or "B" switch to ON.

(6) On NAV MODE select panel, depress LOC.

(7) Set TIC-30A LOC selector to VARIABLE and rotate potentiometer CW, then CCW. HSI course deviation bar will deflect right, then left.

(8) Set TIC-30A GS selector to VARIABLE and rotate potentiometer CW, then CCW. HSI glideslope pointer will deflect down, then up.

(9) The NAV flag must be out of view.

B. Compass Card, Selected Course Pointer and Selected Heading Bug Test

(1) On pilots overhead circuit breaker panel CB1, close circuit breakers CMPS COUPLER (G7), DIR GYRO (G5) and CMPS CPLR-1 (K19); or CMPS CPLR (G26), DIR GYRO (G23) and CMPS CPLR -2 (J19).

(2) On Compass Controller No. 1 or No. 2, press MAG/DG switchlight to MAG, verify compass card agrees with standby compass and MAG flag on HSI is in view.

(3) On HEADING/PITCH MODE panel, adjust set heading control until aircraft heading is displayed in HEADING window. Verify Captains or F/O HSI heading select bug indicates aircraft heading.

(4) On NAV MODE select panel, set the left or right course control so aircraft heading is indicated in COURSE window. Verify Captains or F/O selected course pointer indicates aircraft heading. Verify digital readout in window at top left of HSI indicates same heading. (Some HSIs have no course digital readout incorporated).

C. TO-FROM Indication Test

NOTE: The following test can also be used to check NAV flag and course deviation pointer.

(1) Perform test by using VOR test switch on each receiver front panel or by using VOR TEST switch on each VHF NAV control panel. Ensure ALTN DEV and ALTN HDG switchlights on both INSTRUMENT SOURCE SELECT PANELS are out.

(2) On NAV MODE select panel, set both left and right COURSE selectors to 000 and verify VOR selector is set to SPLIT.

(3) Depress VOR test switch for applicable system, the following should occur:

(a) VOR WARN light on applicable VHF NAV control panel comes on.

(b) NAV flag on applicable HSI comes into view for three seconds and up to nine seconds then goes out of view.

NOTE: If test switch is held for over 14 to 20 seconds, the flags will reappear.

(c) HSI deviation bar deflects momentarily, then returns to center.

(d) HSI, "TO-FROM" indication, will indicate "FROM".

(e) Release VOR TEST switch.

(4) Turn off electrical power (Ref. 24-00-00).

C 4. Additional Test - INS Equipped Aircraft

C A. Prepare for Test

C (1) Set mode selector switch on each INS mode selector unit
C in pilot overhead panel to OFF position.

C (2) Provide electrical power. Refer to 24-00-00.

C (3) Provide cooling air to INS equipment. Refer to
C 21-25-00.

C CAUTION: ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION
C UNITS BEFORE OPERATING INS. FAILURE TO PROVIDE
C ADEQUATE AIR SUPPLY WILL RESULT IN FAILURE OF
C NAVIGATION UNITS.

C (4) Close all INS, HSI and ALT SOURCE SELECT circuit
C breakers on electronic circuit breaker panel.

C B. Test Horizontal Situation Indicators

C (1) Set INS No. 1 or INS No. 2 mode selector switch (pilots
C overhead panel) to ALIGN.

C (2) Set INS No. 1 or INS No. 2 CDU data selector to
C DSRTK/STS and allow INS to align until actual PI number
C goes from 9 to 7.

C NOTE: The PI number is located in position X on
C right-hand CDU display (0YY-X5).

C (3) Set CAPT or F/O RADIO/INS switches to INS position.

C (4) Check to verify that CAPT or F/O RNAV ALTN switches are
C in NORMAL (released) position

C (5) Verify that on both captains and first officers HSI the
C following readings are displayed:

C (a) Heading annunciator reads HDG.

C (b) Source annunciator reads RNAV 1 (capt) RNAV 2
C (F/O).

C (6) Set INS No. 1 or No. 2 CDU data selector to any position except DSRTK/STS.

C (7) Press and hold TEST button on CDU. Observe the following indications on captains HSI.

C (a) Heading flag and navigation annunciator are out of view.

C (b) Course pointer and 0 on azimuth card are positioned under lubber line.

C (c) Course deviation bar is positioned one dot to right of center.

C (d) "ALERT" ANNUNCIATOR is lighted.

C (e) "INS DISTANCE, GND SPEED, TIME digital displays show all eights (8).

C (f) Course window shows all zeros (0).

C (g) TO-FROM pointer indicates TO.

C (8) Release TEST button. Verify that HSI heading and navigation flags come into view.

C C. Restore Airplane to Normal

C (1) Set each INS mode selector switch to OFF position.

C CAUTION: FAILURE TO MOVE MODE SELECTOR TO OFF WILL CAUSE INS TO AUTOMATICALLY SWITCH TO BATTERY POWER AND DEPLETE BATTERY.

C (2) Remove electrical power if no longer required. Refer to 24-00-00.

C (3) Remove equipment cooling if no longer required. Refer to 21-25-00.

DUAL ANTENNA AND ANTENNA FEED ASSEMBLY- REMOVAL AND INSTALLATION

1. Reference Procedure

34-55-00 VOR System - Adjustment and Test

20-51-04 Environmental Sealing

20-24-04 Electrical Bonding

2. Equipment and Materials

Soft clean cloths

Gloves, disposable, MIL-G-36281, or equivalent

Plastic scraper

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279),Mfg. P/N PR1436G-B2, TWA Stk Nbr 50-1188

CR 5 MILX1X1 Pressure Sensitive Al Foil Tape, Y9162A, Minn. Mining and Mfg. Co., St. Paul, Minn., or equivalent.

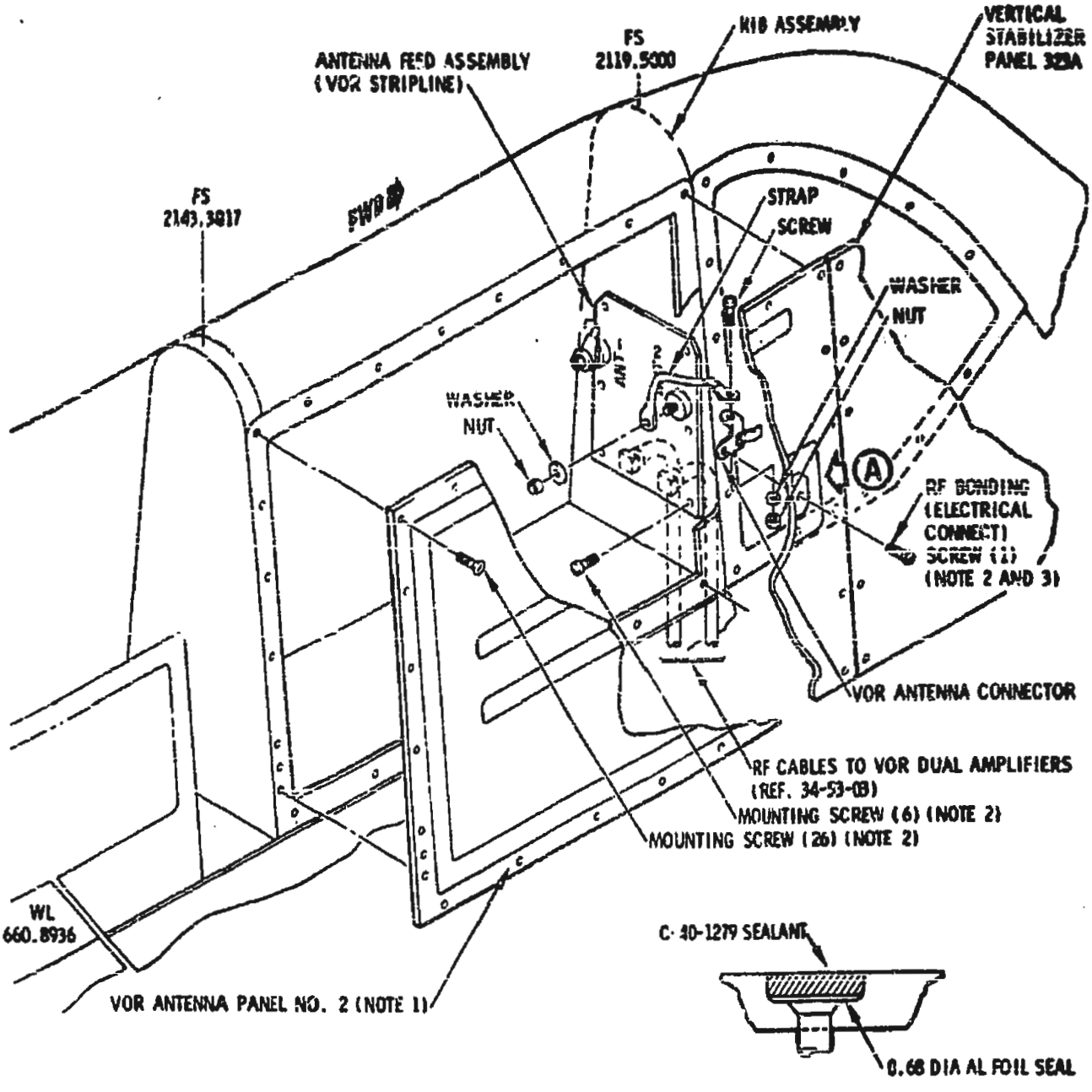
3. Removal/Installation

NOTE: Removal and installation instructions are shown and described for the right side of the aircraft only. Right side component part numbers are followed by the letter R. The letter L is used to signify a left side component.

A. Removal

(1) Locate dual antenna panel 323BR and vertical stabilizer panel 323AR on vertical stabilizer, zone 323, (Ref. Fig. 401).

(2) Remove sealant and seal from RF bonding (electrical connection) screw, then remove screw from antenna panel to be removed.



NOTE

1. VOR ANTENNA PANEL NO. 1 NOT SHOWN. IDENTICAL TO VOR ANTENNA PANEL NO. 2, BUT MOUNTED ON LEFT SIDE OF VERTICAL STABILIZER
2. MOUNTING SCREWS SHOWN WITHOUT NUTS ARE SECURED BY NUTPLATES
3. REMOVE RF BONDING SCREW PRIOR TO REMOVING MOUNTING SCREWS

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R Dual Antenna and Feed Assembly - Removal and Installation
R Figure 401

(3) Remove screws securing 323BR and 323AR panels to vertical stabilizer. Remove panels.

R WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED
R AREA. AVOID FLUID CONTACT WITH SKIN AND EYES.
R PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE
R IRRITATION.

R KEEP MEK AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
R FAILURE TO COMPLY MAY RESULT IN MATERIAL
R COMBUSTION.

(4) Using plastic scraper, remove sealant from vertical stabilizer structure. Using soft clean cloth moistened with methyl-ethyl-keytone solvent, wipe vertical stabilizer structure clean.

(5) If antenna feed assembly is to be removed, proceed as follows:

(a) Remove coax cable clamp from stabilizer near antenna feed assembly to provide slack in coax cables.

CR (b) Carefully disconnect RF cables from connectors on
CR antenna feed assembly.

R (c) Remove nuts and washers securing each strap to antenna feed assembly terminal.

(d) Remove screws securing antenna feed assembly to rib assembly at station 2119.5 and carefully move antenna feed assembly aft.

(e) Remove antenna feed assembly.

CR (f) Carefully check to see that the RF cable coax
CR connectors are not cracked or fractured where the
CR crimp sleeve meets the body of the connector.

B. Installation

(1) Install antenna feed assembly as follows:

WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

(a) Using clean soft cloth moistened with trichloroethane solvent, clean faying surfaces of antenna feed assembly and rib assembly.

NOTE: Ensure a good electrical bond exists between the antenna feed assembly and rib assembly when they are installed (Ref. 20-24-04).

(b) Install antenna feed assembly to aft side of rib assembly at station 2119.5 and secure with six screws to form a good electrical bond.

R R R WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(c) Wearing gloves, apply environmental sealant to the six attaching screws that secure the antenna feed assembly to the rib assembly (Ref. 20-51-04).

(d) Connect straps from each VOR antenna connectors to terminals on aft side of antenna feedline and secure with washers and nuts.

(e) Connect RF connector 3455-P98 to VOR-1 connector on front of antenna feed assembly.

(f) Connect RF connector 3455-P99 to VOR 2 connector on front of antenna feed assembly.

(g) Secure coax cables to stabilizer near antenna feed assembly with coax cable clamps.

R R R R WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AND AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS OR LUNG OR SKIN IRRITATION.

R R (2) Using clean soft cloth moistened with trichloroethane solvent, clean faying surfaces of vertical stabilizer, antenna panel and RF bonding screw hole. Before cleaning solvent dries, wipe dry with clean cloth.

CR (2A) Spray mating surfaces with LPS-3 corrosion inhibitor.

(3) Position 323BR and 323AR panel, aligning screw holes (Ref. Fig. 401).

(4) Install and tighten screws.

(5) Cut a 0.68-inch diameter disc from al foil tape.

(6) Apply foil disc seal over RF bonding screw in recess.

C NOTE: Before applying aerodynamic sealant, remove the
C LPS-3 corrosion inhibitor from the area to be
C sealed as it may prevent adherance of the
C sealant.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

(7) Wearing gloves, apply a continuous sealant fillet between antenna panel and vertical stabilizer structure and RF bonding screw recess using Environmental Sealant (20-51-04), non-conductive aluminum colored polysulfide sealant (LAC Spec C-40-1279), or equivalent.

(8) Perform VOR system adjustment and test procedure (Ref. 34-55-00). Equipment and Materials, and authorized by TW CIC 473-548ML-005.

VHF NAVIGATION ACCESSORY UNIT - REMOVAL AND INSTALLATION

1. Equipment and Materials

Ramp Test Set, TIC T-30A, or equivalent.

R 2. Reference Procedures

R	22-10-00	Autopilot - Description and Operation
R	22-10-02	Navigation Mode Select Panel - Adjustment and Test
R	24-00-00	Electrical Power - Description and Operation
R	34-43-00	Inertial Navigation System - Adjustment and Test
R	34-55-00	VOR System - Adjustment and Test

R 3. Removal/Installation

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION-VHF DC-VOR RCVR (G1) and NO. 2 NAVIGATION-VHF DC-VOR RCVR (G19).

R (2) Open access door 112AB and enter forward electronics service center, zone 113. Locate VHF navigation accessory unit on rear rack, shelf 2 (Ref. Fig. 401).

R (3) Loosen and disengage knurled knobs securing accessory unit to mount.

R (4) Slide accessory unit forward until rear connectors disengage from mating mount connectors. Remove accessory unit.

R B. Installation

R (1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

R (2) Position accessory unit on mount and slide into place, aligning rear connectors and mating mount connectors.

R (3) Place mount clamps over accessory unit hooks. Tighten knurled knobs securing accessory unit to mount.

R (4) Close and secure access door 112AB.

R (5) Remove tags and close circuit breakers opened in Step
R 3A(1).

R 4. Post-installation Check

R A. ALTN relays check

R (1) Position TIC-30 ramp test set outside aircraft at least
R 25 feet from aircraft.

R (2) Position controls on ramp test set as follows:

R (a) Selectors to 0° and TO.

R (b) Turn on test set.

R (c) Turn on TONE switch.

R (3) Prepare VOR system for test (Ref. 34-55-00 Adjustment
R and Test Paragraph 3.A. Preparation).

R (4) Select frequency of local VOR station on Captains VHF
R NAV control panel.

R (5) Select frequency of 108.00-MHz on F/O VHF NAV control
R panel.

R (6) Adjust right COURSE knob, on NAV MODE select panel
R located on glareshield, to move the deviation bar on
R the Captains HSI two dots either side of center.

R (7) Verify ALTN DEV instrument source select switchlights
R are in unlatched position on both instrument panels.

R (8) Select (latch in) ALTN DEV source select switchlight on
R Captains instrument panel.

R (9) Verify course deviation bar on Captains HSI changes to
R agree with F/O HSI and lower, center, right annunciator
R indicates 2.

R (10) Unlatch Captains ALTN switchlight.

R (11) Repeat Step 4A(8) using F/O ALTN switchlight, course
R deviation bar must agree with Captains HSI and F/O HSI
R annunciator must indicate 1.

R (12) Unlatch F/O ALTN switchlight.

R B. VOR/ILS relays check

R (1) Position TIC-30 ramp test set outside aircraft at least
R 25 feet from aircraft.

R (2) On ramp test set, set controls as follows:

R (a) Extend LOC and GS antennas.

R (b) Set bar connecting LOC and GS switches to on.

R (c) Set LOC and GS selectors to ON COURSE.

R (3) Prepare VOR system for test (Ref. 34-55-00 Adjustment
R and Test Paragraph 3.A. Preparation).

R (4) Select a frequency of 108.1-MHz on both VHF NAV control
R panels.

R (5) Verify GS pointer and LOC deviation bar is centered
R within one-half bar width on both HSI.

R (6) Select a frequency of 108.0-MHz on both VHF NAV control
R panels.

R (7) Verify GS pointer and LOC deviation bar change
R position.

R C. NAV - R/NAV relay check

R (1) Position TIC-30 ramp test set outside aircraft at least
R 25 feet from aircraft.

R (2) Position controls on test set as follows:

R (a) Selectors to 0° and TO.

R (b) Turn on test set.

R (c) Turn on TONE switch.

R (3) Select fequency of 108.0-MHz on both VHF NAV control
R panels.

R (4) Verify RADIO/INS switchlights on center console are in
R RADIO position.

R (5) Verify Inertial Navigation System (Ref. 34-43-00) is
R operating.

R (6) Select INS on Captains RAD/INS switchlight while
R observing the Captains HSI.

R (a) Indications must change and source and system
R annunciators on Captains HSI must indicate NAV and
R 1.

R (7) Select INS on F/O RAD/INS switchlight while observing
R F/O HSI.

R (a) Indications must change and source and system
R annunciators on F/O HSI must indicate NAV and 1.

R (8) Return RAD/INS switchlights to RAD.

R D. NAV 1 - NAV 2 relays check

R (1) Position ramp test set outside aircraft at least 25
R feet from aircraft.

R (2) Position controls on test set as follows:

R (a) Selectors to 0° and TO.

R (b) Turn on test set.

R (c) Turn on TONE switch.

R (3) Select frequency of 108.0-MHz on both VHF NAV control
R panels.

R (4) Place either autopilot in CMD, and/or at least one FD
R on (Ref. 22-10-00).

R (5) On NAV MODE panel, depress NAV switchlight (Ref.
R 22-10-02).

R (6) Verify VOR-SPLIT is selected on NAV MODE panel.

R (7) Verify VOR capture by observing if VOR is annunciated
R on AFCS MODES panel.

R (8) Verify "V" bars are in view and FD flag out of view on
R both ADIs.

R (9) On pilots overhead circuit breaker panel CB1, zone 210,
R open VOR RCVR (G1) circuit breaker.

R (10) On Captains ADI, verify "V" bars go out of view and FD
R flag comes into view.

R (11) On NAV MODE panel, select 2 on SPLIT-1-2 switch.

R (12) On Captains ADI, verify "V" bars are in view and FD
R flag out of view.

R (13) On pilots overhead circuit breaker panel CB1, zone 210,
R close VOR RCVR (G1) circuit breaker.

R (14) On NAV MODE panel, place SPLIT-1-2 switch in SPLIT
R position.

R (15) On pilots overhead circuit breaker panel CB1, zone 210,
R open VOR RCVR (G19) circuit breaker.

R (16) On F/O ADI, verify "V" bars go out of view and FD flap
R comes into view.

R (17) On NAV MODE panel, select 1 on SPLIT-1-2 switch.

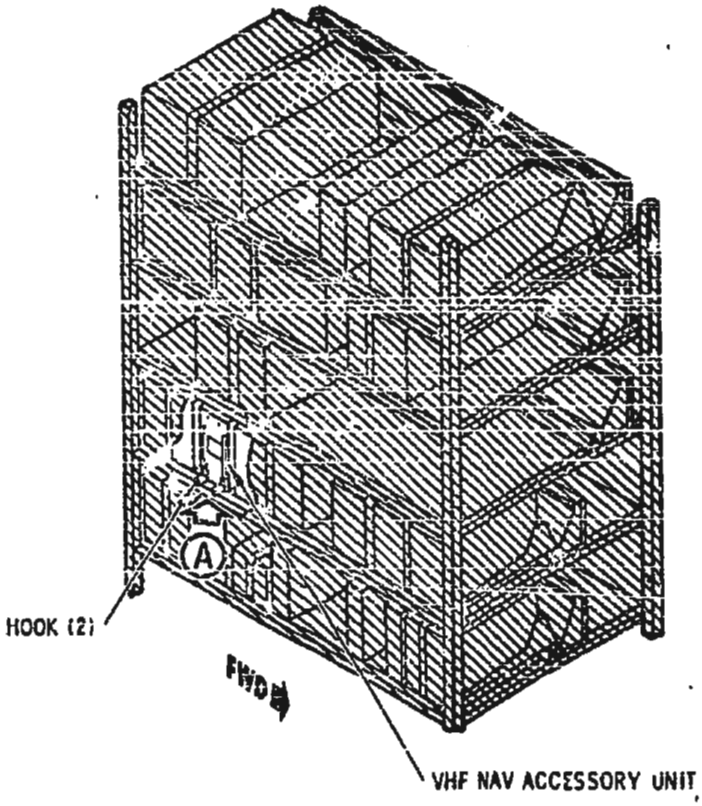
R (18) On F/O ADI, verify "V" bars are in view and FD flap out
R of view.

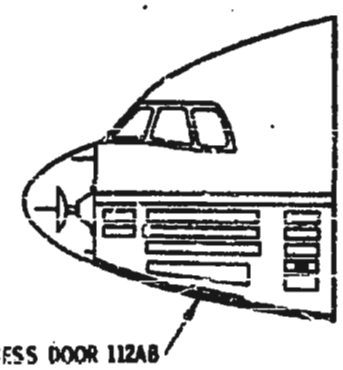
R (19) On pilots overhead circuit breaker panel CB1, zone 210,
R close VOR RCVR (G19) circuit breaker.

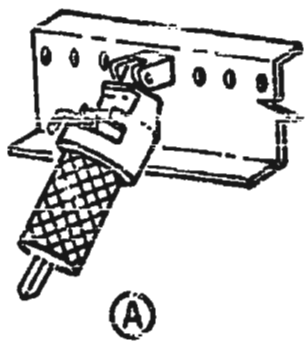
R (20) On NAV MODE panel, place SPLIT-1-2 switch in SPLIT
R position.

R (21) Turn autopilot and FD off.

R (22) Turn electrical power off (Ref. 24-00-00).







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R VHF Navigation Accessory Unit - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
0018

C

OMEGA NAVIGATION SYSTEM - DESCRIPTION AND OPERATION

C

1. General

C A. The dual Litton LTN-211 OMEGA Navigation Systems are installed on Five Star Airlines L-1011-1 aircraft (Planes 11001 and 11002) and are composed of the following unit.

Name	R&R No.	Mfr P/N
Receiver Processor Unit (RPU)	58127	457300-04-34
Control Display Unit (CDU)	58128	458100-02-02
Antenna Unit (AU)	58129	510028-2

C B. The OMEGA units are located in the airplane as indicated below:

OMEGA Unit (Qty)	Location
RPU (2)	FESC - L.H. Avionics Rack - Shelf 4
CDU (2)	Cockpit - Forward Pedestal - No. 1 Left and No. 2 Right
AU (2)	Lower Fuselage - Sta. 640, No. 1 Left and No. 2 Right

C C. Each OMEGA System is powered by a 2-1/2 amp circuit breaker located on the Pilot's Overhead Circuit Breaker Panel (CB-1) at locations E8 (No. 1) and E26 (No. 2). Prior to replacing the RPU, CDU or AU, pull out (deactivate) the appropriate "OMEGA NAV" circuit breaker to prevent system damage.

C D. The OMEGA Systems are independent of each other except for the waypoint cross - loading feature that allows waypoint data to be transferred from one OMEGA system to another using the appropriate CDU procedure.

C E. The Litton OMEGA equipment repair is being performed by Litton Aero Products Division under the warranty agreement. Consult the ICS for each R&R unit warranty repair shipping information.

F. The Litton OMEGA software program incorporated in the RPU is P/N 211-34-02. The CDU display position "POS" displays the software program number at turn-on as "211 34 02" across the left and right displays.

G. The No. 1 OMEGA System supplies data to the Captain's HSI, ADI and "A" Autopilot/Flight Director. The No. 2 OMEGA System supplies data to the F/O's HSI, ADI and "B" Autopilot/Flight Director. The "RNAV ALTN" alternate source select switches are placarded "DISABLED" and are not operative since cross-cockpit OMEGA data switching is not incorporated.

H. Two "VHF NAV/OMEGA" NAV switchlights are installed on the forward pedestal (Captain's - left and F/O's - right) to select the VOR/ILS data display or the OMEGA data display on the HSI. The switchlight will annunciate the "VHF NAV" or "OMEGA NAV" and the HSI source annunciator will display VOR (or ILS) or RNAV, respectively. A VOR frequency must also be selected on the VHF Nav frequency selector to display OMEGA Data on the HSI. For OMEGA coupling to the Autopilot/Flight Director, at least one VHF NAV/OMEGA NAV switchlight must be selected to OMEGA NAV prior to depressing NAV on AP/FD mode panel. For VOR/ILS coupling, both VHF NAV/OMEGA NAV switchlights must be selected to VHF NAV prior to depressing NAV on AP/FD mode panel.

NOTE: The two VHF NAV/OMEGA NAV switchlights have the Greek symbol OMEGA on the switchlight; the word OMEGA is not spelled out on the switchlights.

I. On the FESC L.H. Aft, No. 4 shelf between the No. 1 and No. 2 RPU, a Radio/OMEGA Accessory Tray is installed. This tray includes switching relays, jumpers and loading resistors to integrate certain OMEGA functions with existing aircraft wiring and provide switching for certain HSI display functions as shown below:

	HSI Display Selection	
HSI Display Item	VHF NAV	OMEGA NAV
Heading Card	Magnetic Heading (from compass coupler)	Magnetic Heading (From OMEGA RPU)
Digital Data (From Speed, Distance and Time-to-go)	Shutters in view	Digital data available

HSI Display Selection

HSI Display Item	VHF NAV	OMEGA NAV
MEM Light (OMEGA in dead reckoning mode)	Inactive	Active
Glide Slope display	Active in ILS frequency	Blank
Source Annunciator	VOR or ILS	RNAV
No. 2 Annunciator	No Effect	2 (F/O HSI)

Spare relays are stowed (with relay socket) on inboard side of the accessory tray for replacement purposes if needed. Consult wiring diagram Chapter 34-56-03 in the MSL-TR binder for wiring details of the accessory tray and vendor part numbers. OMEGA No. 1 Wiring Diagram is Chapter 34-56-01 and OMEGA No. 2 Wiring Diagram is Chapter 34-56-02.

NOTE: In several places, these wiring diagrams reference existing area navigation wiring diagrams (Chapter 34-42-XX) where they are used for the OMEGA installation.

J. The existing VHF Nav Accessory Unit is used to switch the remaining HSI display functions between the "VHF NAV" and "OMEGA NAV" functions as shown below:

HSI Display Selection

HSI Display Item	VHF NAV	OMEGA NAV
NAV Flag	VOR or ILS Flag	OMEGA NAV Flag
To/From Pointer	VOR To-From	OMEGA To-From
XTK Dev	Low Level Dev	OMEGA High Level Dev
Alert Light	Inactive	Illuminates approx 2 minutes to waypoint
No. 1/No. 2 Source Annunciator	1 or 2 (Capt) 2 or 1 (F/O)	1 (Capt) 2 (F/O)

K. The OMEGA Nav System uses magnetic heading from the compass couplers and the true airspeed from the CADC's as shown below:

	Magnetic Heading	True Airspeed
No. 1 OMEGA	No. 1 Compass Coupler	No. 1 CADC
No. 2 OMEGA	No. 2 Compass Coupler (Pins 48, 49, 50 of P1) (Hdg No. 5)	No. 2 CADC (Pins 20, 21, 22 of P3) (AC Volt Ratio)

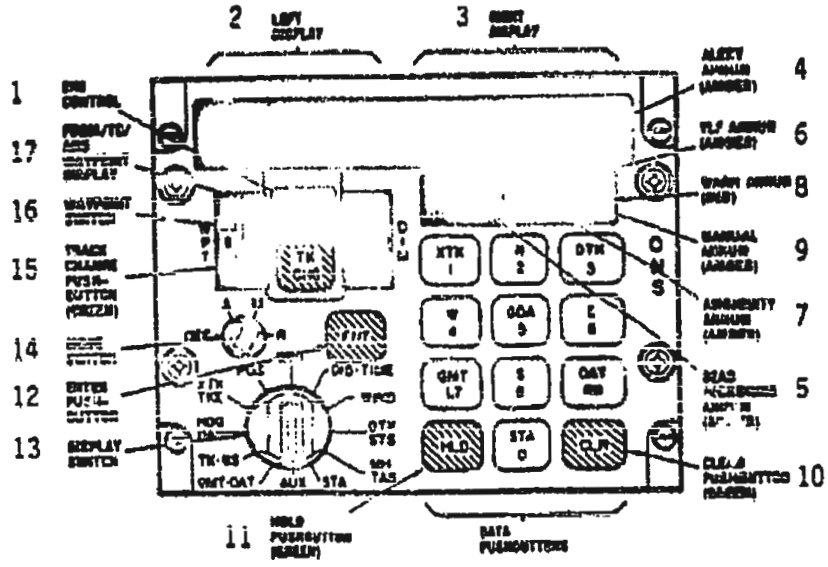
L. The OMEGA Antenna Units are very reliable and should not need replacement. In the unlikely event that an antenna unit requires replacement, it is important to insure that the mounting screws are returned to the same position in the new antenna to prevent screw bottoming out on the fuselage, mounted dome nuts. Do not over-torque the mounting screws to prevent stripping the dome-nut threads.

NOTE: There are four different length mounting screws due to the different thickness of structure inside the fuselage.

M. For detailed description of the OMEGA CDU display and controls, see paragraph 2, CDU Description below.

2. CDU Description

A. The LTN-211 CDU is shown below. Detailed description follows:



ITEM NO.	NOMENCLATURE	FUNCTION
1	DIM control	When rotated upward, reduces intensity of left (2), right (3), and From/To (17) displays. When rotated downward, increases intensity of displays.
2	Left display	Displays data selected by display switch (13).
3	Right display	Displays data selected by display switch (13).
4	ALR (alert) annunciator (Amber)	Comes on when aircraft is two minutes from next waypoint. If mode switch is set to A, goes out when track leg change occurs; if mode switch is set to M, flashes when aircraft is one-half minute from next waypoint and continues to flash until manual track leg change is made.

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Control Display Unit Controls and Annunciators
Figure 1 (Sheet 1 of 6)

ITEM NO.	NOMENCLATURE	FUNCTION
5	Dead reckoning (DR) annunciator (Amber)	Comes on during initialization sequence or if system Omega navigation capability is lost. Extinguishes when system enters navigation mode.
6	Very low frequency (VLF) annunciator (Amber)	Comes on whenever the system is operating with signals from VLF stations as the primary navigation source.
7	Ambiguity (AMB) annunciator (Amber)	Comes on when an Omega position ambiguity is detected. Extinguishes when ambiguity disappears.
8	Manual data entry (MAN) annunciator (Amber)	Comes on when manual entry for TAS, MH, and XTK offset is made by the operator. Remains lit until all manual entries have been zeroed out by the operator.
9	Warn (WRN) annunciator (Red)	When steady indicates system failure has been detected by the integrity monitoring function. When flashing indicates insufficient data entered by operator, TAS or MH becomes invalid, or after a power failure of between seven seconds and seven minutes. Flashes when action codes 1 or 2 are displayed, but not action code 3. NOTE: When annunciators (4) through (9) are extinguished, the system is functioning in the normal Omega navigation mode.
10	CLR pushbutton	Clears displayed data if not yet entered, clears system if error is made in data entry routine, and removes flashing WRN light for action codes 1 or 2.
11	HLD pushbutton	Permits position check, editing of waypoint sequence, position update, waypoint editing, review of system malfunction, and release of updated information after power interrupts.
12	ENT pushbutton	When pressed, transfers data displayed on numerical displays into ONS RPU computer.
13	Display switch	Selects data for presentation on left and right numerical displays.

DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY
GMT·DAT provides wave propagation corrections	Greenwich mean time in hours and minutes (from 0001 to 2400) to the nearest minute.	Date is the calendar date-month, day, year. Month-one or two digits (1 thru 12). Day-two digits (01 thru 31). Year-two digits only (last two digits). Ex. 030180 = March 1, 1980.
TK·GS	Aircraft track angle measured clockwise from north from 0 to 359.9 degrees.	Aircraft velocity relative to earth's surface from 0 to 999 nm/hr.
HDG DA	Aircraft heading from 0 to 359.9 degrees. If a grid offset angle (GOA) has been entered, indicates grid heading.	Aircraft drift angle. Indicates right (R) or left (L) and 0 to 39.9 degrees.
XTK TKE	Aircraft cross-track distance measured perpendicular to desired track. Displays L or R and 0 to 399.9 nm.	Track angle error left or right (L, R) of desired track from 0 to 180 degrees.
	NOTE: Cross-track and track-angle show zero until a track-angle has been inserted in the From/To waypoint display.	
POS Allows entry of present position.	Indicates latitude of aircraft's present position.	Indicates longitude of aircraft's present position.
	NOTE: With the display switch in POS and HLD pressed, the display of present position latitude and longitude is frozen. This does not stop position computation in the computer but is a convenient way of position reporting.	
WPT Indicates positions along in-flight route.	Latitude of up to nine stored waypoints corresponding to digit on waypoint switch.	Longitude of up to nine stored waypoints corresponding to digit on waypoint switch.
DIS·TIME	Distance-to-go, from 0 to 9999 nm. to waypoint currently selected for navigation.	Time-to-go, from 0 to 999.9 minutes, and assumes a ground speed of 480 knots at true airspeeds less than 110 knots.
	NOTE: Distance-to-go and time-to-go are blank until track leg is inserted in the From/To waypoint display.	
WIND	Wind direction from 0 to 359 degrees.	Wind velocity from 0 to 399 knots.
	NOTE: Wind direction is direction with respect to north, measured cw from north.	

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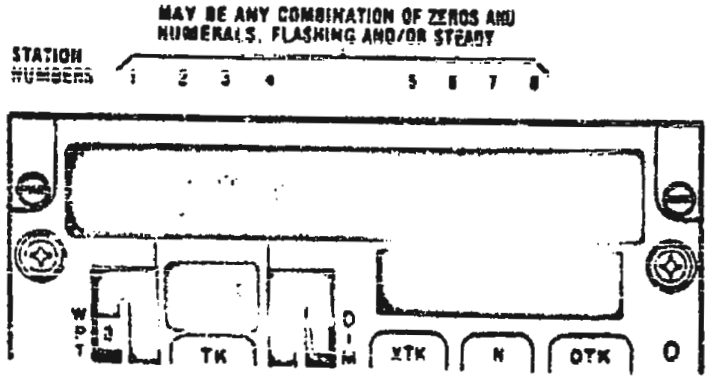
Control Display Unit Controls and Annunciators
Figure 1 (Sheet 3 of 6)

DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY
DTK STS	Computes desired track-angle between selected waypoints, shown in the From/To display, from 0 to 359.9 degrees. DTK indicates 0 until a track leg is inserted in the From/To display.	Status codes (figure 25) and malfunction codes (figure 101) are both displayed in right display.
MH TAS	Aircraft heading measured clockwise from magnetic north to the aircraft's longitudinal axis.	Valve of the current filtered synchro input from an external data source or the display of a manually entered value. If the TAS has been manually entered in a response to a malf code, the MAN annunciator will be lit until all manual entries have been zeroed out by the operator.
STA	Current status of all eight Omega stations as shown below. See figure 22 for stations locations.	



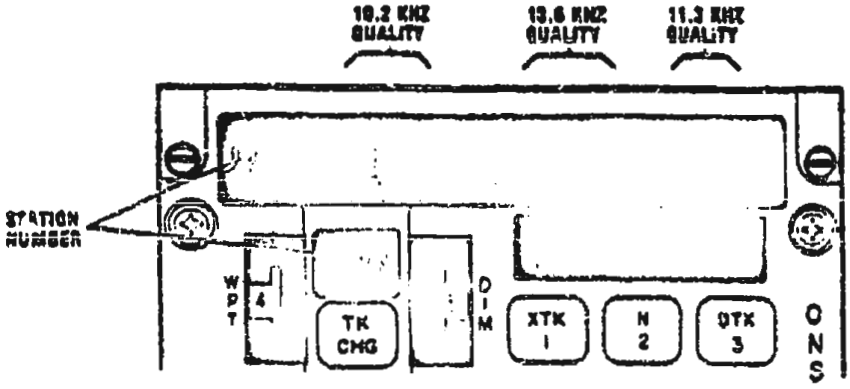
NUMERAL ON STEADY	=	Station in Use
NUMERAL FLASHING	=	Station available, not in use now
ZERO ON STEADY	=	Station automatically deselected
ZERO FLASHING	=	Station manually deselected

NOTE: Station status displays will all be zeros until status 30 has been completed.

DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY

STA (Cont)

Station signal quality is obtained by pressing keyboard pushbuttons 1 through 8.



All three frequencies for a station must be between 12 and 40 for station quality to be considered useful.

To obtain signal-to-noise ratio (SNR) in DB, subtract 20 from displayed station signal quality.

An indication of 00/06 on all frequencies indicates this location is being used for antenna calibration.

AUX By setting WPT thumbwheel to the appropriate number, the following functions are available:

WPT	FUNCTION
0	Retaining Press 0 Press ENT
1	GS/DA entry
2	Scratch memory
3	Station frequencies being used (10.2 13.6, 11.3 kHz)
4	Spare
5	VLF station status. See figure 22 for stations locations.

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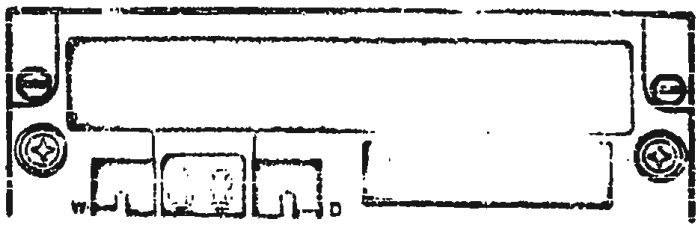
C C C Control Display Unit Controls and Annunciators Figure 1 (Sheet 5 of 6)

ITEM NO.	NOMENCLATURE	FUNCTION
	6 Spare	
	7 Spare	
	8 Spare	
	9 Lamp Test	



NOTE: A flashing station number indicates the RPU computer is evaluating station signal quality for use in navigation computation.

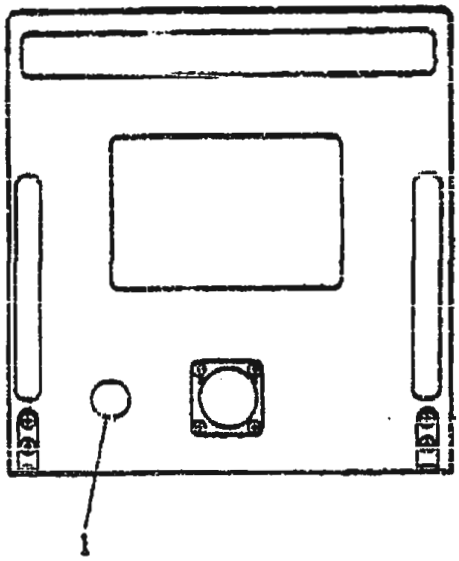
14 Mode switch — Select ONS operating mode as follows:

SET TO	MODE
OFF	Nonoperating; all power removed from ONS.
A	Autopilot operation; with ONS tied to autopilot, aircraft automatically switches to next track leg at waypoints and permits manual override.
M	Manual operation; operator action required before aircraft switches to next track leg at waypoint.
R	Enables remote ranging operation.

15 TK CHG pushbutton — Provides for entry of initial track leg and allows manual track leg switching.

16 Waypoint (WPT) — When the display switch (13) is set to WPT, the switch selects waypoints 1 through 9 for presentation of waypoint coordinates on left (2) or right (3) displays.

17 From/To waypoint — Displays From and To waypoint number of track leg being navigated or position of waypoint switch when WPT or AUX is selected on display.



ITEM NO.	NOMENCLATURE	FUNCTION
1	BITE Indicator	When set (black and white pattern), indicates that ONS has failed.

Receiver Processor Unit Indicators

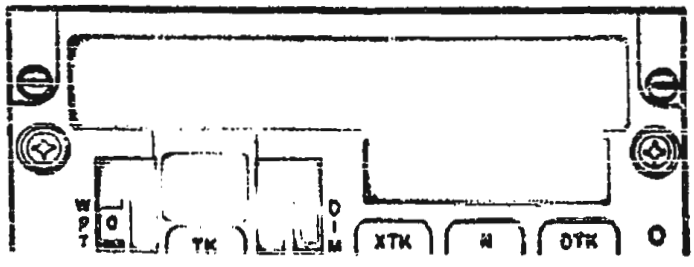
Figure 19

3. **Operation**

ONS operation consists of system turn on by setting mode switch to A or M; entry of present position coordinates, GMT and date; entry of waypoint coordinates; and system checkout.

The ONS should align to status 01 as explained in figure 25. The ONS includes a data entry monitoring feature which will display on OE (operator error) on the right display when an erroneous entry is attempted. To assure status 01, operate aircraft on APU power or aircraft power.

For example, if an incorrect entry procedure is used, such as GOA5 being pressed instead of N during latitude entry, the displays will be as follows and CLR will come on.



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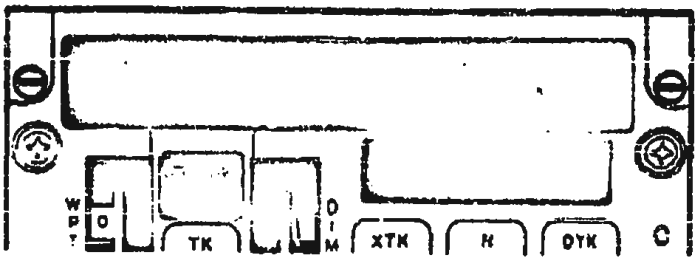
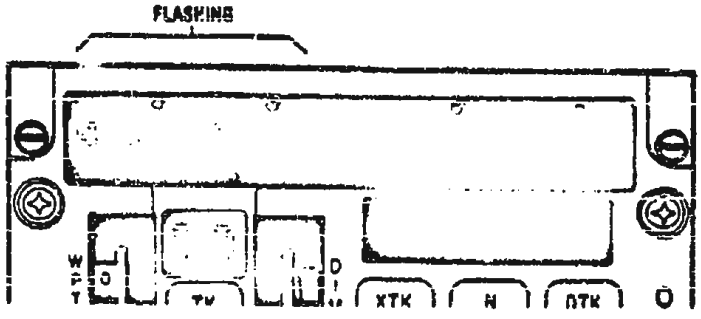
Or, if an incomplete entry is made, such as entering latitude only and then setting the display switch to DTK STS, the displays will be as follows and CLR will come on.



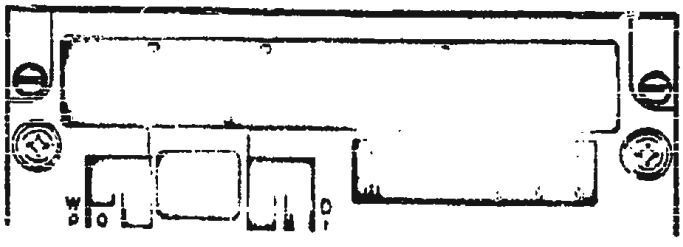
Also, if an invalid entry is attempted, such as entering a latitude of north 92°, the displays will be as follows and CLR will come on.



The operator must respond to the error message by pressing CLR and reentering the data.

A. System Turn On

(1) Set display switch to POS and mode switch to A or M. For approximately five seconds, TK CHG, ENT, HLD, CLR and all annunciators will be on, and displays will be as follows:



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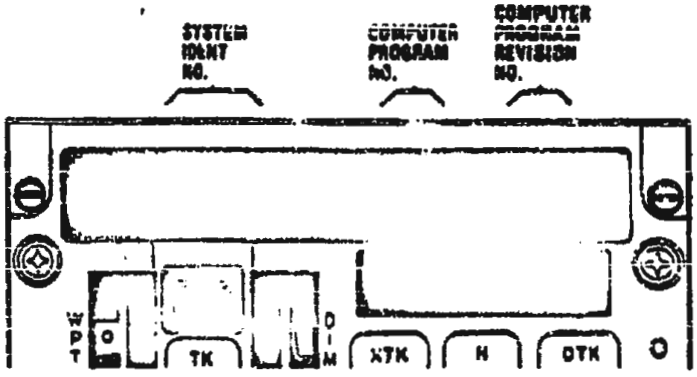
(2) After five seconds; only ENT will be on, the annunciators will be off, and the left and right displays will show the system identification number, the computer program number, and the computer subprogram number as follows:



B. Present Position Entry

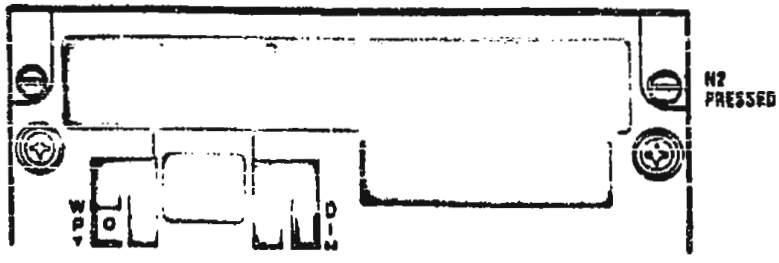
Present position may be entered manually using the following procedures or, with certain programs, may be entered using previous position data displayed on system turn on. To accept the previous position data, press ENT and note that the flashing display characters stop flashing, indicating acceptance of the data. If either the latitude or longitude coordinates is to be changed, perform the appropriate step of the following manual procedure. Then press ENT a second time to accept the parameter that was not changed.

(1) Display switch is on POS.

(2) Press pushbuttons as follows:

N for northern hemisphere
S for southern hemisphere

Displays will be as follows:



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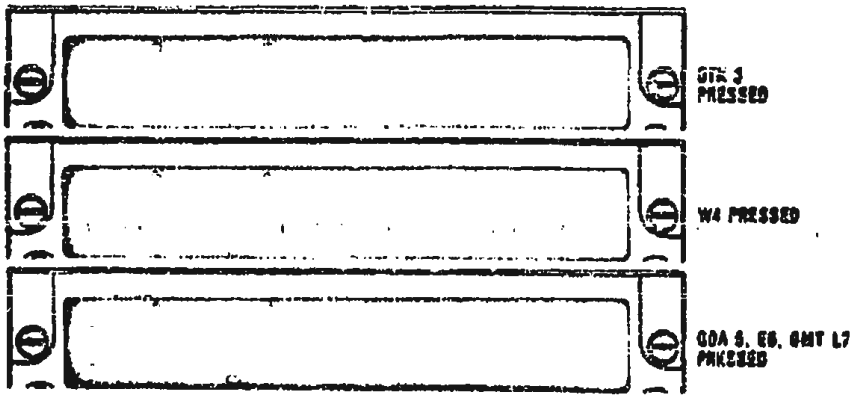
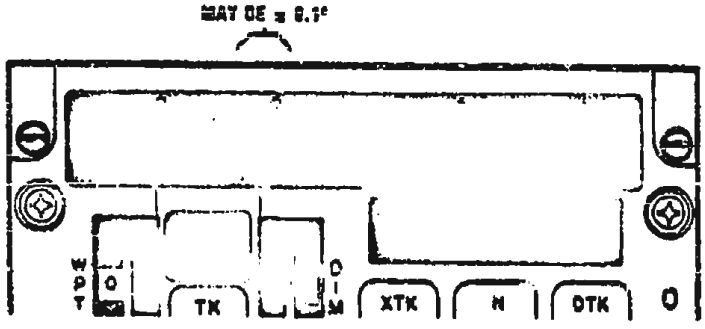
(3) Load present position latitude, starting with most significant digit by pressing corresponding pushbuttons. Each time a pushbutton is pressed, preceding entry will move left until latitude is completely loaded. Displays will be as follows (using latitude 34° 56.7' north as an example):

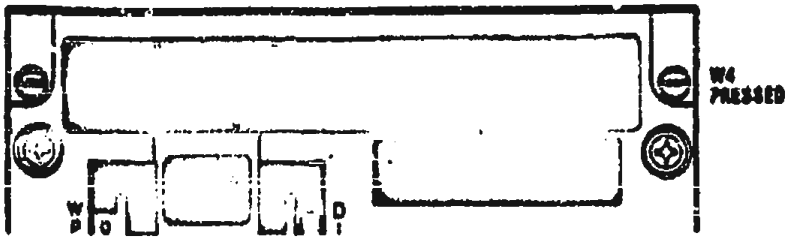


(4) Press ENT. Displays will be as follows:

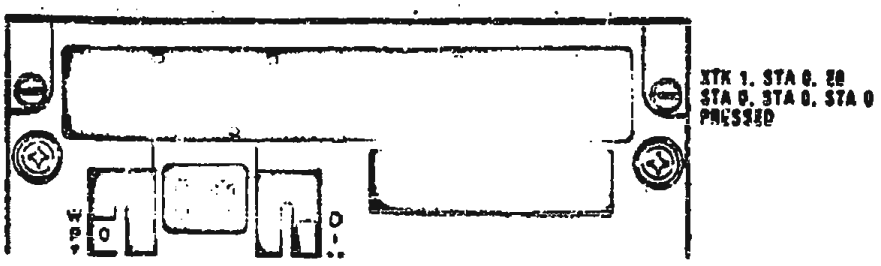


(5) Press pushbuttons as follows:

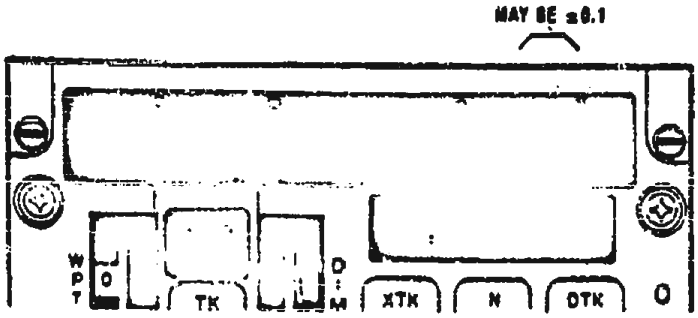
W for western hemisphere
E for eastern hemisphere



(6) Load present position longitude in the same manner as latitude. Displays will be as follows (using longitude 106°00.0' west as an example):



(7) Press ENT. It will remain on, DR annunciator will come on, and displays will be as follows:



NOTE: ONS is now in dead reckoning mode; it will enter navigate mode when status 01 is reached in approximately three minutes. To read status, set display switch to DTK STS.

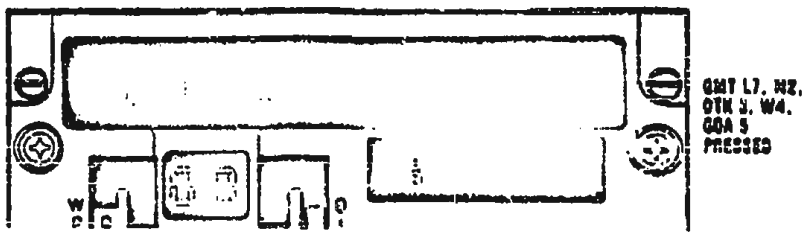
MI-0000-34-5031

C. GMT and Date Entry

GMT and date may be entered manually using the following procedures or, with certain programs, may be entered using previous data displayed on system turn on. To accept previous time and date data, press ENT and note that the flashing display characters stop flashing, indicating acceptance of the data. If either the time or date is to be changed, preform the appropriate step of the following procedure. Then press ENT a second time to accept the parameter that was not changed.

Enter time and date manually as follows:

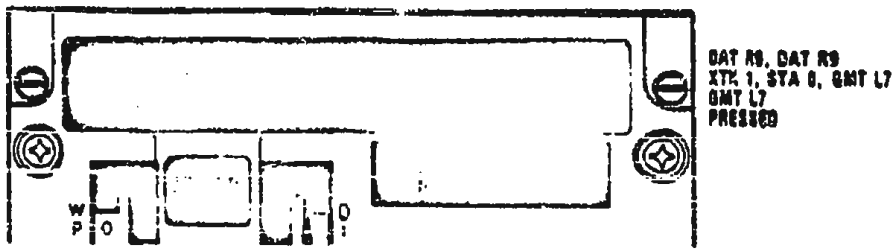
(1) Set display switch to GMT-DAT. Press GMT. Load GMT in same manner as latitude. Displays will be as follows (using GMT of 23 hours 45 minutes):



(2) Press ENT. It will remain on.

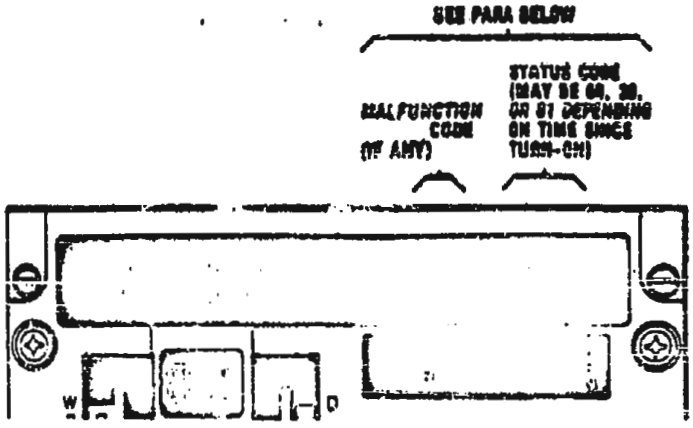
(3) Press DAT. Right display will blank.

(4) Load date in same manner as latitude, in month-day-year sequence. Displays will be as follows (using date of 9-10-77, for example):



(5) Press ENT; it will go out.

(6) Set display switch to DTK STS. Displays will be as follows

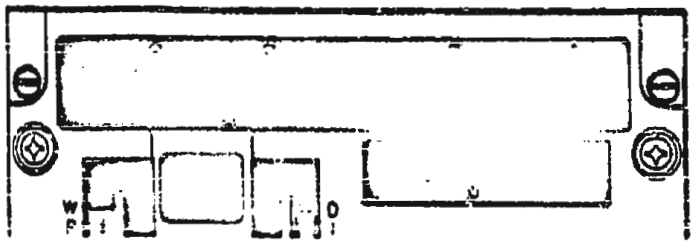


Definitions of malfunction codes are provided in figure 101.

D. Waypoint Coordinates Entry

Enter waypoints manually as follows:

(1) Set display switch to WPT and WPT switch to 1. Display will be as follows:



MJ-0000;34-5033

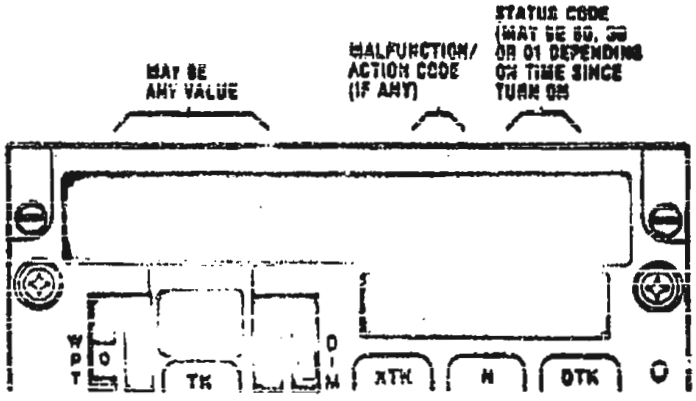
(2) Load waypoint 1 latitude and longitude (load local latitude plus 2 degrees and local longitude) in the same manner as present position, noting that ENT goes out when pressed to enter latitude, comes on when W or E is pressed, and goes out when pressed to enter longitude.

NOTE: Waypoint 0 is an automatic function that is reserved for establishing a track from the aircraft present position and cannot be used to enter waypoint coordinates.

E. Operational Checkout

STATUS CHECK

(1) Set display switch to DTK STS. Displays will be as follows:

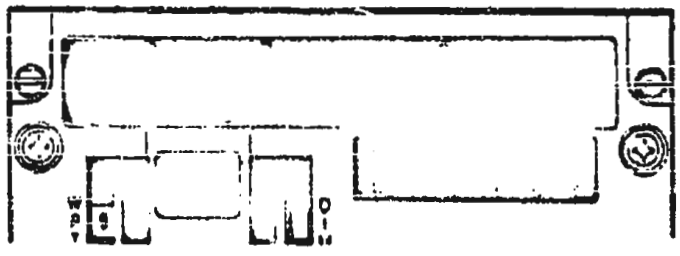


(2) When status becomes 01, press TK CHG. It and ENT will come on and From/To display will blank.

(3) Verify mode switch is set to A or M, then press 0, 1, and ENT. TK CHG and ENT will go out and From/To display will be 01.

DISPLAY TEST

(4) Set display switch to AUX and WPT switch to 9. Displays will be as follows and TK, CHG, ENT, HLD, and CLR will be on.



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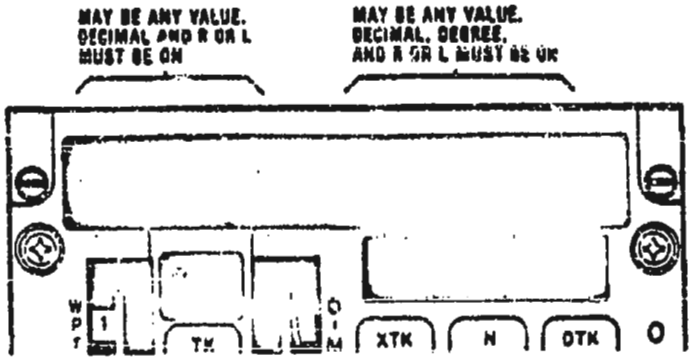
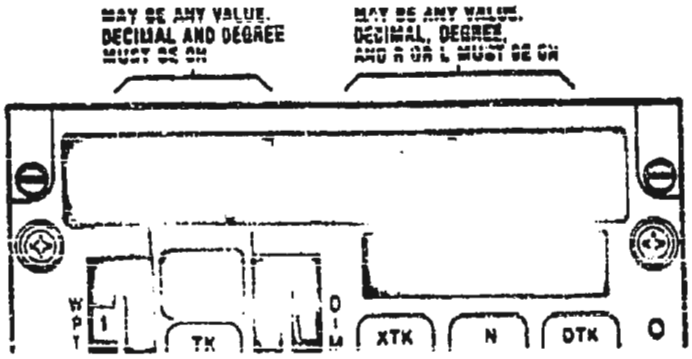
(5) Set mode switch to M and display switch to XTK TKE. Displays will be as follows:

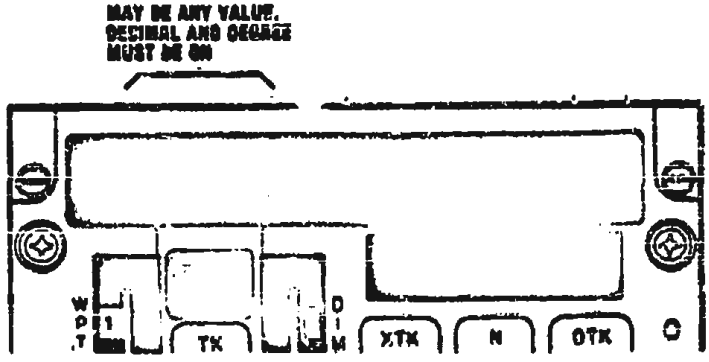


(6) Set display switch to HDG DA. Displays will be as follows:

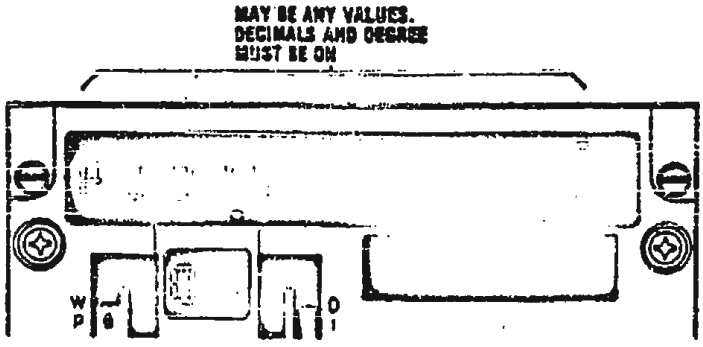


M1-0000-34-5035

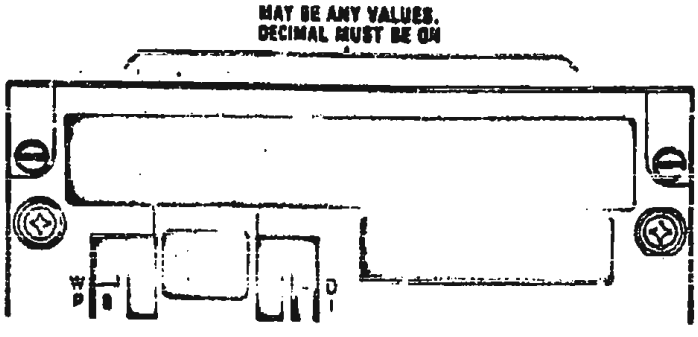
(7) Set display switch to TK-GS. Displays will be as follows:



(8) Set display switch to XTK TKE. Displays will be as follows:

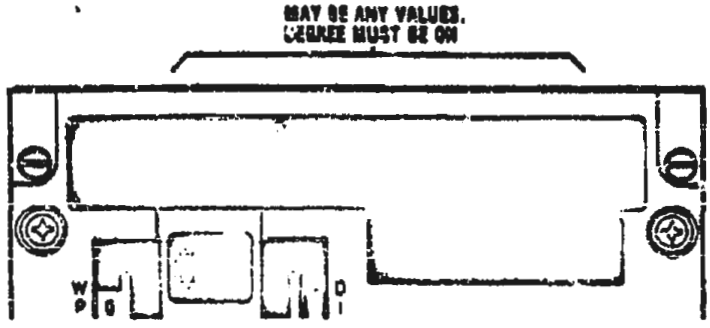


(9) Set display switch to DIS-TIME. Displays will be as follows: (120, Any Value)



M1-0000-34-5036

(10) Set display switch to WIND. Displays will be as follows:



HSI, FLIGHT DIRECTOR AND AUTOPILOT INTERFACE TEST

When the aircraft is on the ground, the true airspeed is zero, and the From/To display is 00, the signals shown in the tabular portion of Figure 20 are available to the flight director computer for use by the HSI and FLT DIR for interface test verification. To perform the test:

(11) Set display switch to AUX position and WPT switch to 9. Select at least one "VHF NAV/Ω NAV" sw to "Ω nav" and press NAV on A/P Mode panel. Lift FLT DIR engage sw. For autopilot test, clear ailerons and provide hydraulic power. Lift autopilot "A" engage switch. Then lift autopilot "B" engage switch. Check for "RNAV" on AFCS Mode Panel.

(12) Set mode switch progressively to automatic (A), manual (M), and remote (R). Check that VHF NAV Selector is on any VOR Freq.

(13) Verify that the values shown in figure 20 are correct.

NOTE: The data shown in figure 20 are only true when the From/To display is 00. When a track leg is inserted, the steering, XTK, and TKE outputs are computed in relation to the track leg data.

POWER INTERRUPT CHECK

(14) Pull aircraft OMEGA NAV 115 400 Hz circuit breaker out (off) for less than seven seconds, then press back in (ON).

(15) Set display switch to DTK STS. Status code will be 60 or 30, and will count down to 01.

(16) Pull circuit breaker out for seven seconds, then press back in. HLD will be ON, and WARN annunciator will be flashing. Status code 60 or 30.

(17) Press HLD. It and flashing WRN annunciator will go out, status code will count down to 01.

SHUTDOWN

(18) Set mode switch to OFF.

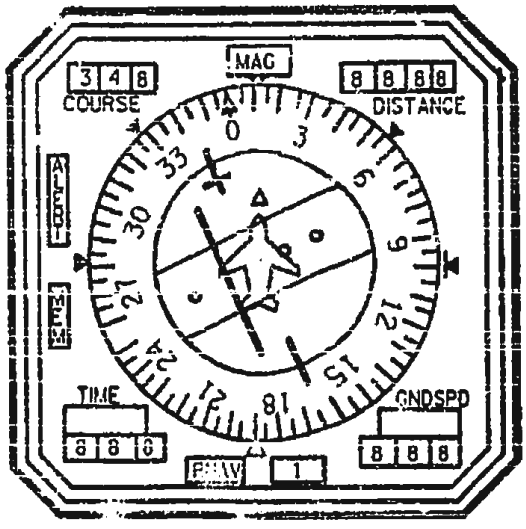
4. **Theory of Operation**

The ONS comprises an antenna, CDU, and RPU. It receives input signals from eight transmitters strategically located around the world (reference Omega Transmissions paragraph) and from the Navy VLF communications network. It selects at least three of the transmitted signals for use in navigating the aircraft along a preselected, point-to-point great-circle route to a destination. It also receives various inputs (figure 21) and provides (depending upon its configuration) outputs to aircraft instruments and systems.

Selection of the three signals occurs during a sequence of events (reference Alignment Sequence paragraph) that starts when the mode switch is set from OFF to A or M. The sequence ends when the ONS has synchronized with the signals, selected the most suitable signals, and automatically entered the navigate mode.

Certain navigational parameters are computed by the ONS, and made available for display on the CDU and aircraft instruments (reference Available Displays, paragraph C).

SYSTEM SELF-TEST OUTPUTS	MODE SWITCH SETTING		
	A	M	R
DTK	348.75°	0°	11.25°
XTK	L 3.75 NM (bar left)	0°	R 3.75 NM (bar right)
STEERING	ROLL LEFT 30°	0° ROLL	ROLL RIGHT 30°
HDG	11.25°	0°	348.75°
Autopilot	Wheel CCW	Wheel Active	Wheel CW



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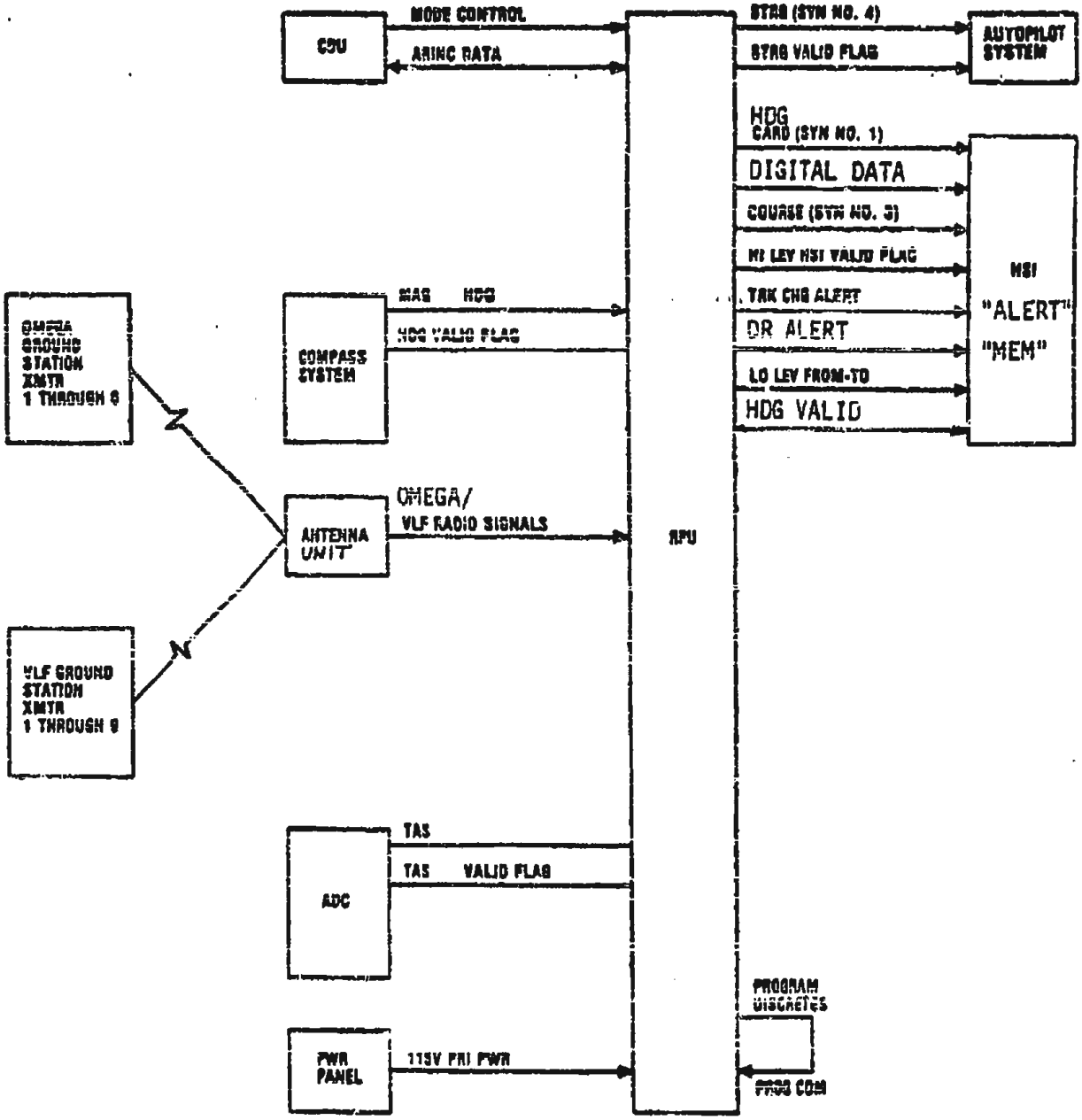
"A" Mode Sw Setting
Flight Director Interface Test
Figure 20



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C
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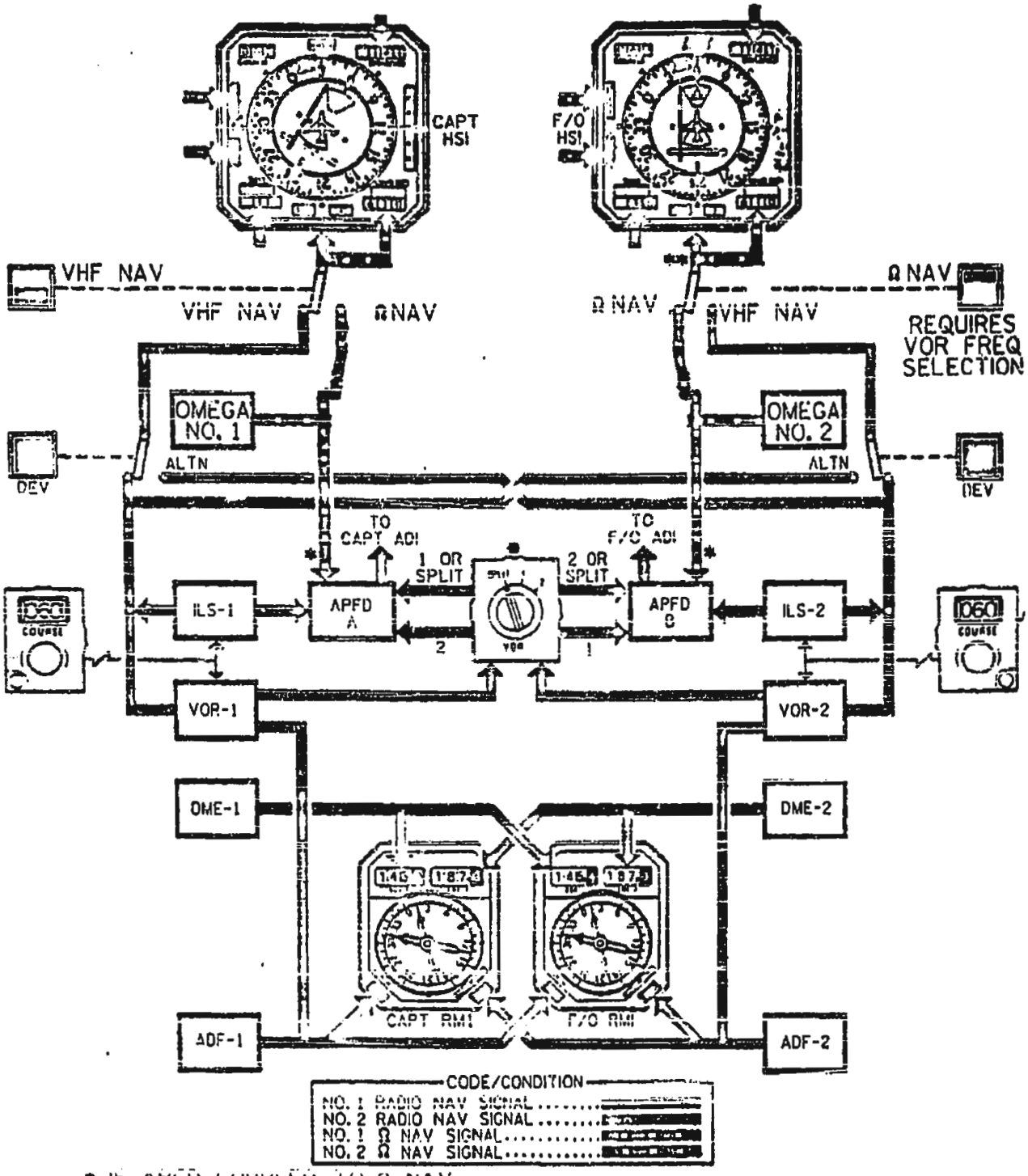
ONS Block Diagram
Figure 21



* IF APFD COUPLED TO Ω NAV
** MAG HEADING AND Ω CROSSTRACK DEVIATION PROVIDED, ALSO DIG. DATA, TO-FROM, ALERT LT, MEN (DR) LT, DSRTK (ON COURSE POINTER).
* IF APFD IN NAV MODE FOR VOR OPERATION.

M1-0000-34-5040

A. Omega Transmissions

The Omega system comprises eight transmitters located as shown in figure 22. Each transmitter broadcasts bursts of very low radio frequency energy on the same three frequencies in the same sequence; however, each has its own unique duration-of-bursts pattern (figure 23) that is identifiable by the ONS.

The time slot allocated to the 11.05 kHz OMEGA frequency is used by the ONS to receive VLF signals. Four of the nine VLF stations (figure 22) are selected on the basis of geometry and signal strength. Each station is sampled at 120 samples per second for an approximate one-second burst every five seconds. The VLF stations transmit one of three possible frequencies depending on transmission format, as shown in figure 24. All three must be sampled to determine the active mode based on signal-to-noise ratio (SNR).

STATION DESIGNATION		LOCATION	LATITUDE	LONGITUDE
		OMEGA STATIONS		
1	(A)	Norway	66° 25.2' N	13° 08.2' E
2	(B)	Liberia	6° 19.3' N	10° 39.9' W
3	(C)	Hawaii	21° 24.3' N	157° 49.9' W
4	(D)	North Dakota	46° 21.9' N	98° 20.1' W
5	(E)	La Reunion	20° 59.5' S	55° 17.4' E
6	(F)	Argentina	43° 12.2' S	65° 11.5' W
7	(G)	Australia*	38° 28.9' S	143° 56.1' E
8	(H)	Japan	34° 38.9' N	129° 27.2' E
		VLF STATIONS		
1		Norway	67° 04.0' N	14° 04.0' E
2		England (Rugby	52° 22.2' N	01° 11.9 W
3		Hawaii	21° 25.5' N	158° 09.3 W
4		U. S. (Washington State)	48° 12.2' N	121° 55.0' W
5		U.S. (Maryland)	38° 59.1' N	76° 27.2' W
6		U.S. (Maine)	44° 30.9' N	67° 16.9' W
7		Australia	21° 49.0' S	114° 09.9' E
8		Japan	34° 58.2' N	137° 01.3' E
9		England (Anthorne)	54° 54.9' N	03° 16.4' W

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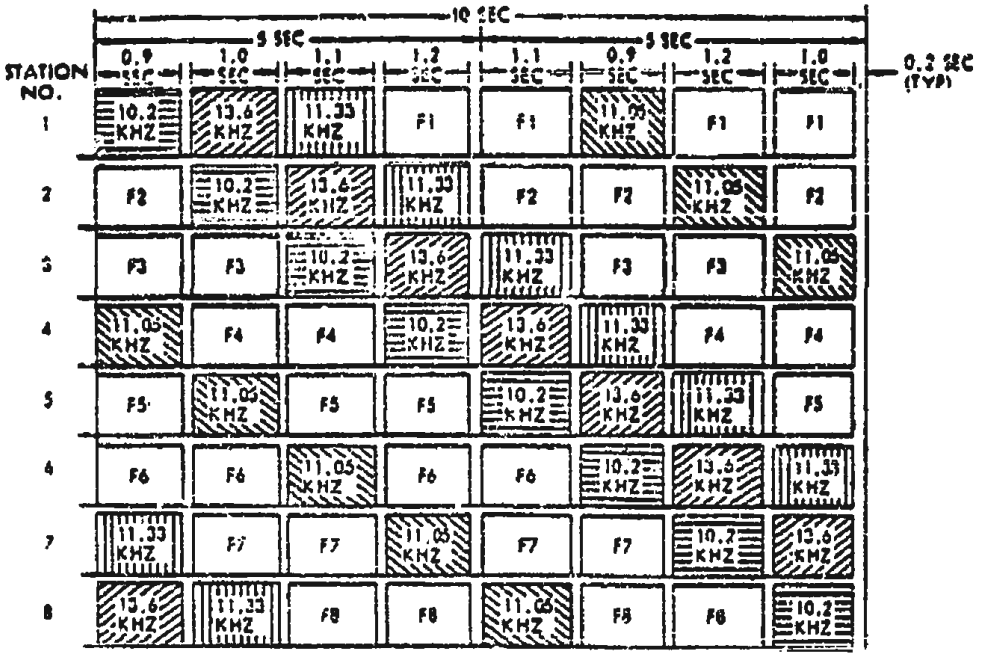
C
C Locations of OMEGA and VLF Transmitters
Figure 22



NOTE:

1. F1 THRU F8 ARE SLOTS FOR PROPOSED IDENTIFYING FREQUENCIES, EACH UNIQUE TO ITS STATION.
2. 11.05 KHZ FREQUENCY IS DECODED ONLY BY ONS WITH 4-FREQUENCY CAPABILITY

Transmission Patterns of Omega Transmitters

Figure 23

VLF STATIONS	FREQUENCY ALLOCATIONS*					
	FSK (0)		MSK 1 (4)		MSK 2 (2)	
	f_o (KHZ)	$f_{L.O.}$ (KHZ)	$f_o - f_m$ (50 HZ) (KHZ)	$f_{L.O.}$ (KHZ)	$f_o - f_m$ (50 HZ) (KHZ)	$f_{L.O.}$ (KHZ)
(JXN) NORWAY	16.4	61.875	16.350	61.825	16.375	61.850
(GBR) GREAT BRITAIN	16.0	61.475	15.950	61.425	15.975	61.450
(NPM) HAWAII	23.4	68.875	23.350	68.825	23.375	68.850
(NLK) WASHINGTON	18.6	64.075	18.550	64.025	18.575	64.050
(NAA) ANNAPOLIS	21.4	66.875	21.350	66.825	21.375	66.850
(NAA) MAINE	17.8	63.275	17.750	63.225	17.775	63.250
(NWC) AUSTRALIA	22.3	67.775	22.250	67.725	22.275	67.750
(NDV) JAPAN	17.4	62.875	17.350	62.825	17.375	62.850
(GBZ) ANTHORNE	19.0	64.475	18.950	64.425	18.975	64.450

*OTHER STATIONS TO BE LISTED

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VLF Frequency Allocations
Figure 24

The resulting VLF phase information is initialized at the position of the receiver when the signal comes on line with an acceptable SNR. Subsequent changes in phase are resolved through clock drift and position change.

All transmissions are phase-locked to a precise time standard so that the three frequencies cross zero phase with a positive slope every 16/17ths of a millisecond. The phase of the transmissions shifts as the distance from the transmitters changes, with the result that the time between the positive-going zero crossing of a reference signal generated by the RPU and the positive-going zero crossing of the received signal can be calculated, and the distance between the receiver and the transmitter can be determined, thus locating the position of the aircraft.

B. Alignment Sequence

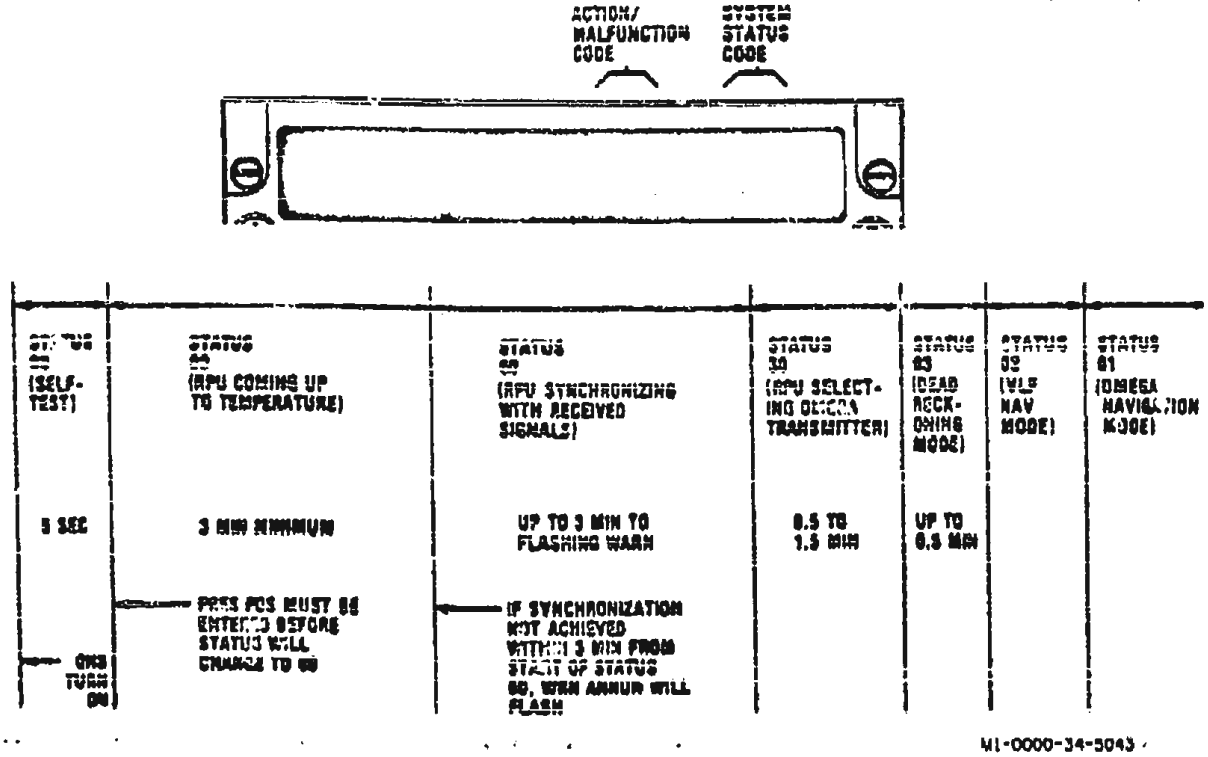
When the mode switch is set from OFF to A or M, the ONS begins an alignment sequence (figure 25) that starts with a status 90 (the status number appears in the right display when the display switch is set to DTK STS) and decrements through 80, 60, 30, 03, 02 to 01, which is the ONS navigate mode status.

Completion of the alignment sequence requires that the operator enter certain data through the CDU; these data are present position latitude and longitude, GMT, and date. They are usually entered as soon as the five-second display test is ended (see Status 90). If any of them are omitted, the ENT pushbutton will remain on after the presumed final entry is made, a malfunction code of 15 will be displayed (reference Action/Malfunction Codes paragraph, Troubleshooting section).

Other data must also be entered by the operator if automatic navigation is to be used. These are waypoint's latitude and longitude and, if the aircraft's systems are not supplying them, true airspeed and magnetic heading.

Following are definitions of the modes identified by the status numbers.

Status 90: Self-test mode; all display segments, the six annunciators, and TK CHG, ENT, HLD, and CLR pushbuttons are on. The RPU performs an antenna test; if the


ACTION/ MALFUNCTION CODE
SYSTEM STATUS CODE
STATUS 90 (SELF-TEST)
STATUS 80 (RPU COMING UP TO TEMPERATURE)
STATUS 60 (RPU SYNCHRONIZING WITH RECEIVED SIGNALS)
STATUS 30 (RPU SELECTING OMEGA TRANSMITTER)
STATUS 03 (DEAD RECKONING MODE)
STATUS 02 (VLF NAV MODE)
STATUS 01 (OMEGA NAVIGATION MODE)
5 SEC
3 MIN MINIMUM
UP TO 3 MIN TO FLASHING WARN
0.5 TO 1.5 MIN
UP TO 0.5 MIN
PRES POS MUST BE ENTERED BEFORE STATUS WILL CHANGE TO 60
IF SYNCHRONIZATION NOT ACHIEVED WITHIN 3 MIN FROM START OF STATUS 60, WRN ANNUN WILL FLASH
ONS TURN ON
MI-0000-34-5043

C
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Alignment Sequence
Figure 25

WRN annunciator will flash after the five-second display test ends, a malfunction code of 7 will be displayed.

Status 80: RPU coming up-to-temperature mode.

Status 60: Synchronization mode; the RPU samples the received signals and compares them with what their pattern should be. The antenna is used as an omnidirectional device during status 60.

Status 30: Station selection mode; the RPU examines all received signals. It will reject any stations that have been manually deselected and will automatically deselect those that are more than 8000 nautical miles distant, have known diurnal or modal interference problems, or have a signal quality index less than 11.

At least three stations must be selected for the ONS to enter the navigate mode; if less are available, it will remain in the dead reckoning mode; however, after the first hour of operation in the navigate mode the ONS will navigate when only two stations are available.

Station selection continues as long as the ONS is operating so that changing conditions are constantly taken into consideration. As a result, the ONS may revert to the dead reckoning mode at any time if station status deteriorates sufficiently. Overriding the dead reckoning mode by manually reselecting marginal stations that have been automatically deselected is not possible.

If present position is not entered, alignment will remain in status 80. If present position is entered, but not GMT and/or date, alignment will remain in status 3. In both cases, a malfunction code of 15 will be displayed.

Status 03: Dead reckoning; the ONS will enter status 03 if station quality deteriorates sufficiently.

Status 02: VLF mode.

Status 01: ONS in navigate mode.

C

OMEGA NAVIGATION SYSTEM - TROUBLESHOOTING

C 1. General

C This section provides information pertinent to ONS
C troubleshooting.

C 2. Wiring and ACU Cabling Diagrams

C See MSL-TR Book "L1011 Wiring" for TR Chapter 34-56-01, 02, 03
C for OMEGA Wiring Diagrams.

C 3. Troubleshooting

C The relative complexity and the resultant varying
C time-to-failure of the ONS units indicate that failures will
C most probably be the result of a malfunction in the RPU; the
C second most probable cause will be the CDU; and last, the
C antenna. However, trouble shooting where ONS inputs appear to
C be involved, or where an ONS hard failure is not indicated (RPU
C BITE indicator not set) should include a check of aircraft
C wiring, particularly wiring at program discrete pins. In
C addition, information supplied by codes displayed on the CDU
C (reference Malfunction Codes and Scratch Memory Words
C paragraphs) should be used to verify a proposed unit
C replacement.

C In most instances, troubleshooting will be a replace with
C known-good unit procedure starting with the RPU followed by the
C CDU, and lastly the antenna. Because the antenna is not an
C easily substitutable unit, temporary taping of known-good
C antenna to the aircraft skin and using cable external to the
C aircraft should be used.

C After each unit is substituted for perform the procedures in the
C Operation paragraph (Page 10) of the Description and Operation
C section, as necessary, to make sure that the cause of the
C failure has been corrected.

C 4. Malfunction Code Display

C Troubleshooting may be aided by using codes, generated by the
C ONS, which indicate actual and apparent failures. These codes
C (if any exist at the time) will appear in the right display
C (figure 101) when the display switch is set to DTK STS. Certain
C codes will be accompanied by a flashing WRN annunciator as shown
C in figure 101.

C 5. Master WARN (WRN)

C A steady WARN annunciator at any time except during display
C test, indicates that the system has failed and is no longer
C operative. A flashing WARN annunciator indicates failure of a
C subassembly, loss of aircraft inputs, or insufficient input data
C by the operator. It may be extinguished, if desired, as
C described in the MALFUNCTION CODES paragraph below.

C 6. Malfunction Codes

C When a flashing WARN annunciator occurs, one or more malfunction
C codes (figure 101) will be generated. The codes will be
C displayed when the display switch is set to DTK STS. The codes
C will cycle automatically at a one-per-two-second rate.

C The Flashing WRN annunciator can be eliminated and the
C malfunction codes blanked by pressing the CRL pushbutton after
C each code is displayed and then cycling through the codes a
C second time. For example, malfunction codes of 10 and 12 could
C be cleared as follows:

C 1. Set display switch to DTK STS to display malfunction code
C 10; then press CLR.

C 2. Press HLD pushbutton to display malfunction code 12; then
C press CLR pushbutton.

C 3. Press HLD pushbutton to display 0 0.

C 4. Verify that the malfunction code positions on the right
C display are blank (each time) after the HLD pushbutton is
C pressed and that the flashing WRN annunciator has gone out.

C NOTE: Synchro self-test failures (malfunction codes 19, 20 and
C 21) cannot be blanked.

C To recall malfunction code, press the HLD pushbutton. 0 0 will
C appear. Press CLR pushbutton. Flashing WRN annunciator and
C malfunction codes will again be displayed and will cycle
C automatically.

	MALF CODE	PROBLEM INDICATED	RECOMMENDED ACTION	WRN ANNUN
	01	Computer check sum failed.	Replace RPU.	
	02	Arithmetic check failed.		
	03	A/D converter failed.		
	04	Memory address failed.		
	05	Data check failed.	Check TAS input. If not reasonable, manually enter TAS. If problem persists, replace RPU.	
	06	Multiple input discretes selected.	Request maintenance to check discretes.	
NORMALLY TOGETHER	07	RF/ACU failed.	Replace RPU. If problem persists, request maintenance to check ACU and cable.	
NORMALLY TOGETHER	08	OSC OUT OF TOLERANCE		
	10	No TAS to ONS.	Check ADS CB. If ok, manually enter TAS.	Flashes
	11	No hdg to ONS.	Check compass system CB. If ok, manually enter mag hdg.	
	12	Neither TAS nor hdg to ONS.	Check ADS and compass systems CBs. If ok, manually enter TAS and mag hdg.	
	13	Power interrupt longer than 7 sec.	Check POS, GMT, and DAT. If POS is estimated to have changed by more than 8 nm, update. Update GMT and DAT as necessary.	
	14	System not synched with Omega transmission at 3 min. from turnon.	None. System will continue sync. Usually occurs only on ground in poor reception areas.	
	15	Incomplete initial data entry.	Make sure POS, GMT, and DAT entered.	
	17	No 26 vac to RPU.	Check CBs. Codes 19, 20, 21 will be present.	Out. Acft instrument flags indicate failure.
	18	No autopilot exc.	Check autopilot CB and system.	
	19	Synchro no. 1 output failed.		
	20	Synchro no. 2 output failed.	Do not use ONS for steering or HSI drive.	
	21	Synchro no. 3 output failed.	Record codes for maintenance.	
	22	Steering output failed.		
	23	Xtk dev output failed.		
	30[3]	VLF self-test failed.	Replace RPU at next maintenance.	Flashes

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Malfunction Codes
Figure 101

OMEGA NAVIGATION SYSTEM - REMOVAL AND INSTALLATION

1. General

Procedures for removing and installing units of the ONS are provided in this section.

CAUTION: PREVENT POSSIBLE DAMAGE TO THE ONS BY ALWAYS PULLING ALL ONS AIRCRAFT CIRCUIT BREAKERS OUT (OFF) AND ENSURING THAT THE CDU MODE SWITCH IS SET TO OFF BEFORE REMOVING ANY ONS UNIT.

2. Remove/Install Antenna

Antenna installation requires the use of the consumable materials (or its equivalent) listed in figure 401.

(1) Disconnect antenna cable connector from antenna connector.

(2) Loosen screws that secure antenna to aircraft. Assure that screws are left in respective antenna screw hole for proper re-installation.

(3) Remove antenna from aircraft.

(4) Remove gasket and sealant; thoroughly clean aircraft skin.

(5) Prepare sealants listed in reference figure 401 below.

(6) When installing antenna, install gasket on antenna using sealant.

Consumable Material Used During Antenna Installation
Figure 401

NOMENCLATURE	PART NO.	MANUFACTURER
Sealant (Aerodynamic and Faying Surface) (Preferred)	PR-1436GB-2	Products Research Corp 5454 San Fernando Rd Box 1800 Glendale, CA 91209
Sealant (Faying surface)	EC801	Minnesota Mining and Mfg. Co. Adhesives, Coatings, and Sealers DIV; 3M Center St., St. Paul, MN 55101

Consumable Material Used During Antenna Installation (Cont)
Figure 401

NOMENCLATURE	PART NO.	MANUFACTURER
Connector Seal Kit No. 409 (Connector Shells Sealant)	DMU 75-1	Dorne and Margolin Inc. 2950 Veterans Memorial Hwy Bohemia, NY 11716

(7) Replace screws removed from antenna to pull antenna down and establish seal between aircraft skin, gasket, and antenna. See Fig. 402 for range of screw lengths. Reuse screws in same location of antenna.

(8) Mate antenna cable connector with aircraft connector. Seal between antenna, gasket and aircraft skin with sealant (figure 401) for aerodynamic and faying surface seal. Seal ACU connector with DMU 75-1 (DMU 75-1 is easily removed for ACU removal).

(9) Verify system operation as provided in part of "Operation" paragraph 7, Page 10.

3. Remove/Install CDU

(1) Set CDU mode switch to OFF. Deactivate "OMEGA NAV" circuit breaker (CB-1).

(2) Loosen four turnlock fasteners securing CDU in panel.

(3) Carefully pull CDU from panel.

(4) Rotate locking ring of aircraft wiring connector counterclockwise and disconnect from CDU connector.

(5) Install cap plug on CDU connector.

(6) Remove cap plug from connector of replacement CDU.

(7) Mate aircraft wiring connector with CDU connector.

(8) Rotate locking ring of aircraft wiring connector clockwise to secure connector.

(9) Make sure CDU is right way up, then install in panel and secure with four turnlock fasteners. Activate "OMEGA NAV" circuit breaker.

(10) Verify system operation as provided in part of "Operation" Paragraph 7, Page 10.

C 4. Remove/Install RPU

C (1) Set CDU mode switch to OFF. Deactivate "OMEGA NAV" C circuit breaker (CB-1).

C (2) Disconnect antenna cable connector from RPU connector C J3.

C (3) Rotate knurled nuts, securing RPU in tray, C counterclockwise, until they are free of RPU hook C mounts.

C (4) Pull RPU straight out from tray until RPU connector J1 C disengages from tray connector.

C (5) Remove RPU from tray.

C (6) Install cap plug on connector J3, and in connector J1.

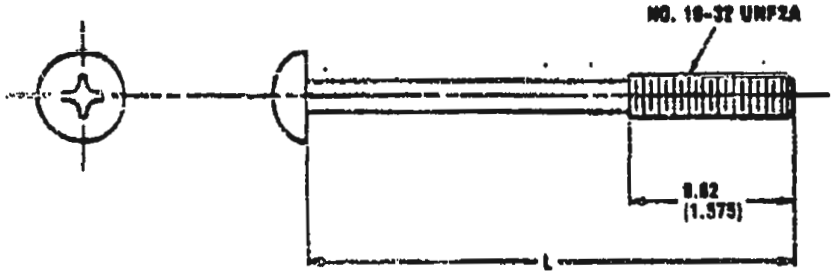
C (7) Remove cap plug from connector J1, of replacement RPU.

C (8) Place RPU in tray and press back until RPU connector J1 C mates with tray connector.

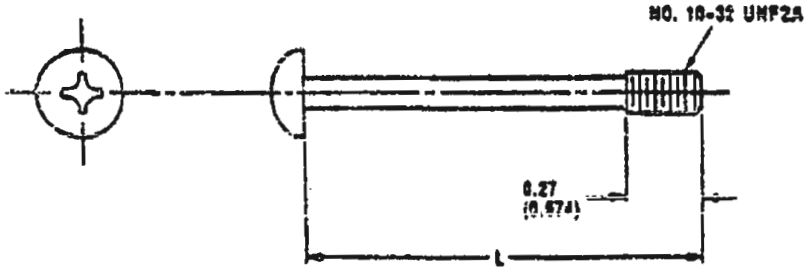
C (9) Secure RPU by engaging hold downs and hook mounts and C rotating knurled nuts clockwise until tight.

C (10) Remove cap plug from RPU connector J3 and mate with C antenna cable connector. Activate "OMEGA NAV" CB.

C (11) Verify system operational as provided in part of C "Operation" paragraph 7, Page 10.



460006-01 THRU -05



460006-06 THRU -09 AND -11 THRU -22

DASH NO.	L (IN.)	L (CM)	DASH NO.	L (IN.)	L (CM)
-01	1.50	3.810	-12	3.276	8.321
-02	1.75	4.445	-13	3.451	8.766
-03	2.00	5.080	-14	3.526	8.956
-04	2.25	5.715	-15	3.651	9.274
-05	2.50	6.350	-16	3.776	9.591
-06	2.651	6.734	-17	3.901	9.931
-07	2.776	7.051	-18	4.026	10.226
-08	2.901	7.369	-19	4.151	10.544
-09	3.026	7.646	-20	4.276	10.861
			-21	4.401	11.179
-11	3.151	8.004	-22	4.526	11.496

Range of lengths used.

NOTE:

DIMENSIONS IN IN., THOSE IN PARENS ARE CM

C

OMEGA NAVIGATION SYSTEM - APPROVED REPAIRS

C 1. General

C Approved repairs for the ONS units are provided in this section.
C Repairs other than those described are not authorized at the
C line maintenance level and, if attempted, may damage the ONS.

C 2. Special tools

C A readout lamp removal tool (figure 801) may be used during the
C Replace Readout Lamps procedures below.

C 3. Replacement Parts

C Replacement parts are illustrated and listed in figure 804 which
C are located at the end of this section. All parts can be
C ordered through Aero Produces Division to ensure compatibility
C with the ONS and conformance with specifications covering the
C requirements for the parts.

C 4. Antenna Repair

C The antenna (figure 803) may be replaced at the line maintenance
C level (reference Removal/Installation section); no repairs are
C authorized.

C 5. CDU Repair

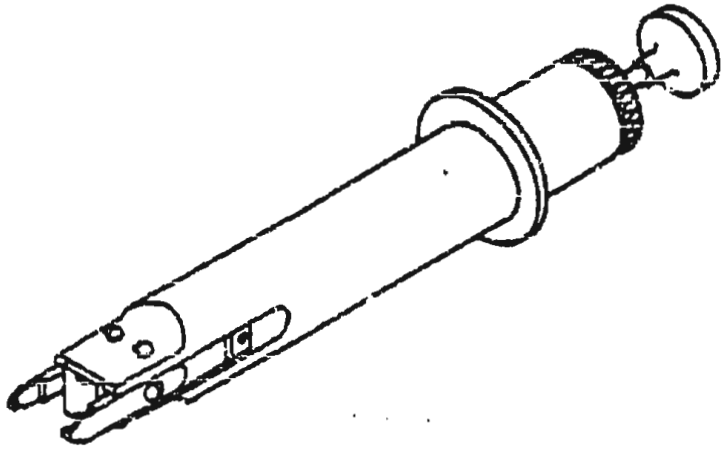
C Repair of the CDU is limited to replacing the following parts
C (reference figure 804): knobs, top panel, bottom panel,
C annunciator and lamps, readout lamps, bipin lamps, pushbutton
C lens caps and lamps.

C A. Replace Knobs

C (1) Loosen setscrews securing knob (8 or 9, reference
C figure 804). Remove from switch shaft.

C (2) Place new knob on shaft and press toward panel, making
C sure that panel-to-knob-skirt clearance is 0.010 to
C 0.050 inch. Tighten setscrews.

C B. Replace Top Panel



NOMENCLATURE/PART NO.	MFR
Readout lamp removal tool/681022	Aero Products Division Canoga Park, CA 91303

C (1) Loosen captive screws securing top panel (3, figure
C 804). Remove panel.

C (2) Place bottom of new top panel against top of bottom
C panel (10); make sure they are pressed firmly together.

C (3) Tighten captive screws until top panel is secure.

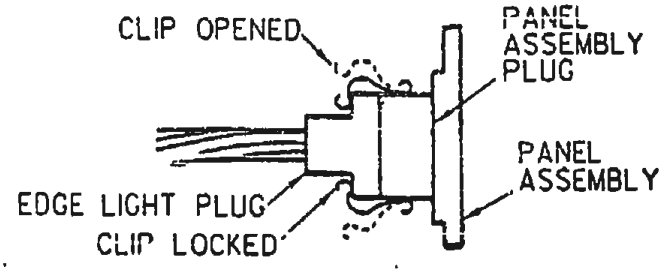
C C. Replace Bottom Panel

C (1) Remove both knobs (reference Replace Knobs paragraph).

C (2) Loosen four captive screws securing top panel (3,
C figure 804) and bottom panel (10).

C (3) Carfully pull panel about one inch away from CDU.

C (4) Using fingers on 3/16-inch wide screwdriver blade, open
C clips (below) securing edge lighting plug; disconnect
C plug.


CLIP OPENED
PANEL ASSEMBLY PLUG
PANEL ASSEMBLY
EDGE LIGHT PLUG
CLIP LOCKED

C (5) Connect edge lighting plug to new bottom panel, then
C lock clips.

C (6) Position panel against CDU.

C (7) Tighten captive screws until panel is secure.

C (8) Place knobs in shafts and press toward panel, making
C sure that panel-to-knob-skirt clearance is 0.010 to
C 0.050 inch.

C (9) Place bottom of top panel against top of bottom panel
C and make sure they are pressed firmly together.

C (10) Tighten captive screws until top panel is secure.

C D. Replace Annunciator Lens Caps and Lamps

C (1) Loosen captive screws securing top panel (3, reference
C figure 804). Remove panel.

C (2) Remove annunciator (28) by removing two screws (29) and
C washers (30).

C (3) Remove defective lamp(s) (31) and replace.

C (4) Install annunciator and secure with screws and washers.

C (5) Replace bottom of top panel (3) against top of bottom
C (10); make sure they are pressed firmly together.

C (6) Tighten captive screws until top panel is secure.

C E. Replace Readout Lamps

C (1) Loosen captive screws securing top panel (3, reference
C figure 804). Remove panel.

C (2) Using fingers or readout lamp removal tool (reference
C figure 801), remove readout lamp (5, 6, or 7, reference
C figure 804, as applicable).

C (3) Position new readout lamp against receptacle; make sure
C lamp is right way up and pins are aligned with sockets.

C (4) Press readout lamp firmly into place so that pins are
C completely seated and lens of readout lamp is flush
C with other readout lamps.

C (5) Place bottom of top panel (3) against top of bottom
C panel (10); make sure they are pressed firmly together.

(6) Tighten captive screws until top panel is secure.

F. Replace Bipin Lamps

To replace bipin lamps (4, reference figure 804) follow the same procedure used to replace readout lamps except that there is no tool for removing the bipin lamps. Plastic tweezers may be used if necessary.

G. Replace Pushbutton Lens Caps and Lamps

(1) Remove bottom panel (10, reference figure 804 and Replace Bottom Panel paragraph).

(2) Remove pushbutton lens cap (11 through 24, as applicable). Lamps (25, 25A, 26 or 26A) will come out in lens cap.

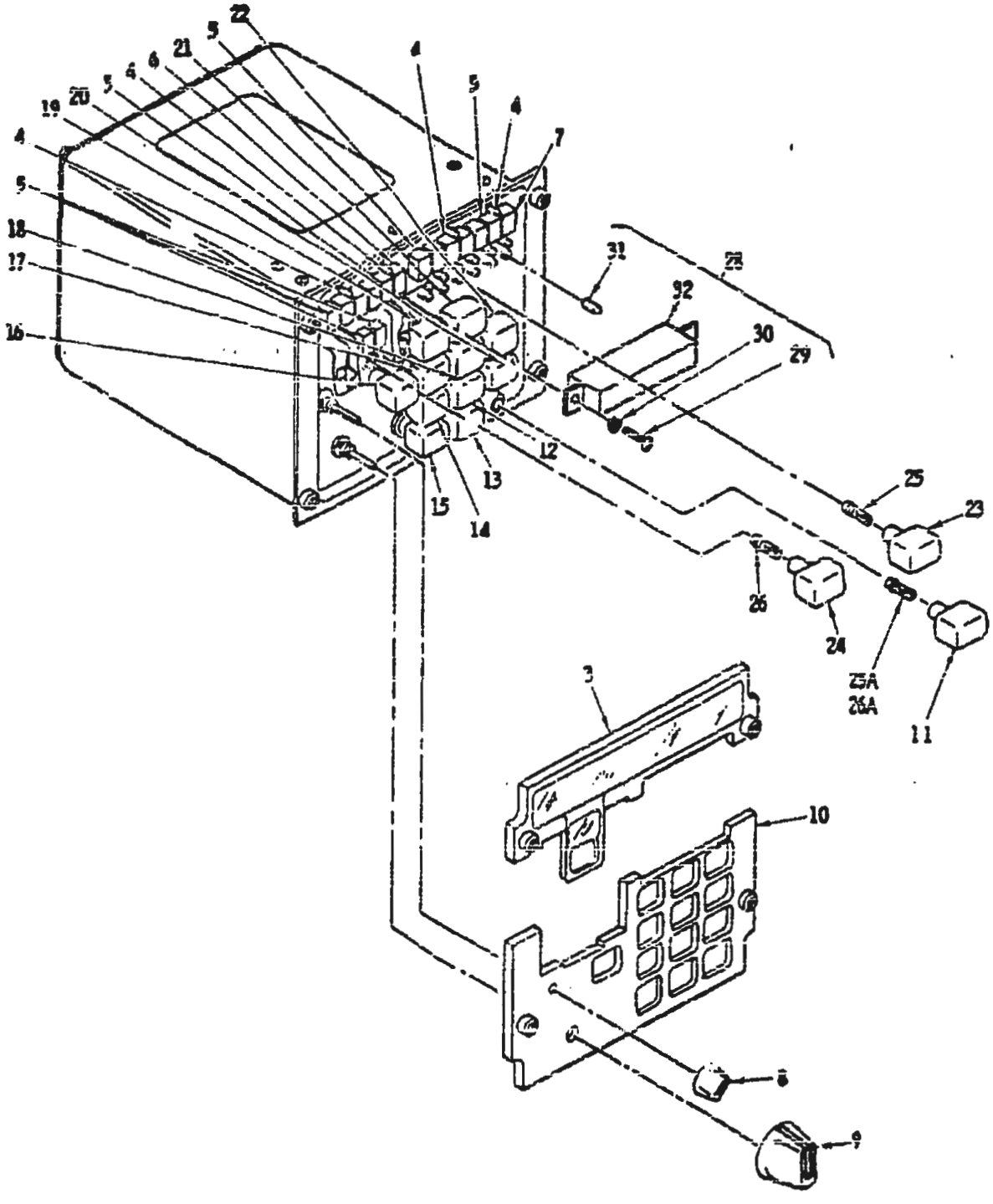
(3) Assemble new lamp and lens cap (or vice versa, if applicable).

(4) Install lamp and lens cap in CDU.

(5) Install bottom panel (reference Replace Bottom Panel paragraph).

6. RPU Repair

The RPU (9, reference figure 803) may be replaced at the line maintenance level (reference Removal/Installation section); no repairs are authorized.



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C Control Display Unit Replacement Parts
C Figure 804 (Sheet 1 of 3)

FIG. ITEM	PART NUMBER	1 2 3 4 5 6 NOMENCLATURE	EFFECT FROM TO	UNITS PER ASSY
804 —1	458100-02-02	CONTROL DISPLAY UNIT—(FOR NHA SEE FIG. 803)	A	RF
~~—1A~~	~~458100-02-03~~	~~CONTROL DISPLAY UNIT—(FOR NHA SEE FIG. 803)~~	~~B~~	~~RF~~
~~—1B~~	~~458100-02-04~~	~~CONTROL DISPLAY UNIT—(FOR NHA SEE FIG. 803)~~	~~C~~	~~RF~~
~~2~~	~~458101-02-02~~	~~• CONTROL DISPLAY UNIT ASSY (REPLACED BY 458101-04-02)~~	~~A~~	~~1~~
~~—2A~~	~~458101-04-02~~	~~• CONTROL DISPLAY UNIT ASSY (REPLACES 458101-03-02)~~	~~A~~	~~1~~
~~—2B~~	~~458101-03-03~~	~~• CONTROL DISPLAY UNIT ASSY (REPLACED BY 458101-04-03)~~	~~B~~	~~1~~
~~—2C~~	~~458101-04-03~~	~~• CONTROL DISPLAY UNIT ASSY (REPLACES 458101-03-03)~~	~~B~~	~~1~~
~~—2D~~	~~458101-04-04~~	~~• CONTROL DISPLAY UNIT ASSY~~	~~C~~	~~1~~
3	458136-01	• • PANEL ASSY—TOP		1
4	500009-1	• • LAMP—TWO CONTACT		6
5	500003-3	• • READOUT—ALPHANUMERIC		13
6	500003-1	• • READOUT—NS AND ALPHANUMERIC		1
7	500003-2	• • READOUT—EW AND ALPHANUMERIC		1
8	TT345-01	• • KNOB—MODE SWITCH (V15084)		1
—8A	MS18064-1	• • • SETSCREW—4-40 NC3A CRES STEEL CUP POINT SELF LOCKING 1/8 IN. LG.		2
9	GP119-02	• • KNOB—DISPLAY SWITCH (V15084) (REPLACED BY 550001-4)		1
—9A	550001-4	• • KNOB—DISPLAY SWITCH (REPLACES GP119-02 (V15084))		1
—9B	NAS1081C04D3N	• • • SETSCREW—CRES STEEL CUP POINT SELF LOCKING		2
10	458144-01	• • PANEL ASSY—BOTTOM		1
11	500034-46	• • CAP—CLR LENS		1
12	500034-53	• • CAP—S8 LENS	A, B	1
—12A	500034-84	• • CAP—S8 LENS	C	1
13	500034-58	• • CAP—STA 0 LENS	A, B	1
—13A	500034-88	• • CAP—STA 0 LENS	C	1
14	500034-54	• • CAP—GMT L7 LENS	A, B	1
—14A	500034-90	• • CAP—GMT L7 LENS	C	1
15	500034-41	• • CAP—HLD LENS		1
16	500034-39	• • CAP—ENT LENS	A, B	1
—16A	500034-80	• • CAP—ENT LENS	C	1
17	500034-51	• • CAP—W4 LENS	A, B	1
—17A	500034-82	• • CAP—W4 LENS	C	1
18	500034-45	• • CAP—GOA 5 LENS	A, B	1
—18A	500034-87	• • CAP—GOA 5 LENS	C	1

NOTE: ITEMS PRECEDED BY A DASH (—) DO NOT APPEAR ON THE ILLUSTRATION.

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C Control Display Unit Replacement Parts
C Figure 804 (Sheet 2 of 3)

FIG. ITEM	PART NUMBER	1 2 3 4 5 6 NOMENCLATURE	EFFECT FROM TO	UNITS PER ASSY
804 18	500034-43	• • CAP—XTK 1 LENS	A, B	1
—18A	500034-85	• • CAP—XTK 1 LENS	C	1
20	500034-55	• • CAP—DAT R8 LENS	A, B	1
—20A	500034-89	• • CAP—DAT R8 LENS	C	1
21	500034-50	• • CAP—N2 LENS	A, B	1
—21A	500034-81	• • CAP—N2 LENS	C	1
22	500034-52	• • CAP—E6 LENS	A, B	1
—22A	500034-83	• • CAP—E6 LENS	C	1
23	500034-57	• • CAP—DTK 3 LENS	A, B	1
—23A	500034-86	• • CAP—DTK 3 LENS	C	1
24	500034-42	• • CAP—TK CHG LENS		
25	345	• • LAMP—INCANDESCENT 5VAC (USED WITH ALL LENS CAPS EXCEPT TK CHG, HLD, ENT AND CLR) (V71744)		10
25A	345	• • LAMP—INCANDESCENT 5VAC (USED WITH CLR LENS CAP) (V71744) (REPLACED BY MS25237-328)		1
26	MS25237-328	• • LAMP—INCANDESCENT 5VDC (USED WITH TK CHG, HOLD AND ENT LENS CAPS)		3
26A	MS25237-328	• • LAMP—INCANDESCENT 5VDC (USED WITH CLR LENS CAP) (REPLACES 345 (V71744))		1
—27	458135-04-01	• • CONTROL DISPLAY UNIT SUBASSY— (REPLACED BY 458135-05-01)	A, B	1
—27A	458135-05-01	• • CONTROL DISPLAY UNIT SUBASSY— (REPLACES 458135-04-01)	A, B	1
—27B	458135-05-04	• • CONTROL DISPLAY UNIT SUBASSY	C	1
28	550016-03	• • • ANNUNCIATOR ASSY		1
29	SCREW	• • • • SCREW—NO. 4-40 UNC2B X 0.25 IN. PAN HD		2
30	WASHER	• • • • WASHER—NO. 4 SPLIT LOCK		2
31	7839	• • • • LAMP—INCANDESCENT (V55300)		12

NOTE: ITEMS PRECEDED BY A DASH (—) DO NOT APPEAR ON THE ILLUSTRATION.

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C
C Control Display Unit Replacement Parts
Figure 804 (Sheet 3 of 3)

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM DESCRIPTION AND OPERATION

1. General

The ADF system (Ref. Fig. 1) consists of the following:

51Y-7 Receiver (with provisions for a second)

Dual control panel

Two Radio Digital Distance Magnetic Indicators (RDDMI)

Two 137A-6 loop antennas (only one used)

Two sense antennas (only one used)

Two 582C-( ) Quadrantal Error Correctors

179J-5 sense antenna coupler (with provisions for a second) (aircraft 001-014)

C 179J-16 sense antenna coupler (with provisions for a second) (aircraft 015-018)

The receiver is located in the mid electrical service center, zone 137. The dual control panel is located on the center console in the flight station, zone 210. The RDDMIs are located on the Captains and First Officers instrument panels in the flight station, zone 210. The antennas are flush-mounted to the fuselage bottom-centerline at FS 1043, zone 143. The error correctors are mounted on each loop antenna. The sense antenna coupler on aircraft 001-014 is located in the MESC. The sense
C antenna coupler and lightning arrestor on aircraft 015-018 is located in the MLG fairing area above the sense antenna, zone 143. Each of the four audio selector panels (Ref. 23-51-00) located in the flight station provides two on-off/volume controls for the ADF system audio. The controls are placarded 1-ADF-2; however, only the ADF-1 control is used.

The control panel is a dual unit containing the system mode selector switches, (placarded ADF-OFF-ANT), the frequency selectors, digital frequency readout windows, and the BFO/OFF switches. The control panel is divided into two sections: ADF-1 and ADF-2; however, only the ADF-1 section is used.

The loop antenna consists of two mutually perpendicular loops providing the ADF system directional receiving capability. The loops are mounted on the bottom of the aircraft fuselage with one loop aligned with the fuselage longitudinal axis (fore-aft)

and the other loop aligned with the aircraft transverse axis (wingtip-to-wingtip).

The error corrector neutralizes the loop antenna electromagnetic field distortion caused by the aircraft structure, eliminating induced bearing readout errors. The amount of induced bearing error is the same in each quadrant (quadrantal error); and the error corrector acts as a fixed attenuator to null-out this induced bearing error.

The sense antenna provides the ADF system omnidirectional receiving capability. The sense antenna consists of a conductive coating flame sprayed over a ground plane on the skin of the aircraft (fuselage-bottom). On aircraft 001-014, the sense antenna coupler matches the sense antenna impedance (50 pF) and the sense antenna cable impedance (220 pF) to its
C receiver sense antenna input impedance (3000 pF). On aircraft
C 015-018, the sense antenna coupler matches the sense antenna impedance (300 pF) to the ADF receiver sense antenna input impedance (3000 pF). The RDDMI each contain two VOR/ADF switches, but only the switch on the left side of the indicator controls ADF display selection. The ADF heading information is indicated by pointer No. 1 (single stripe body) when the left VOR/ADF switch is in the ADF position.

The receiver acquires and processes the signal from a selected radio station. This data is applied to the RDDMIs which visually display the relative bearing to the station. The receiver audio output is applied to the audio distribution panels.

2. Operation

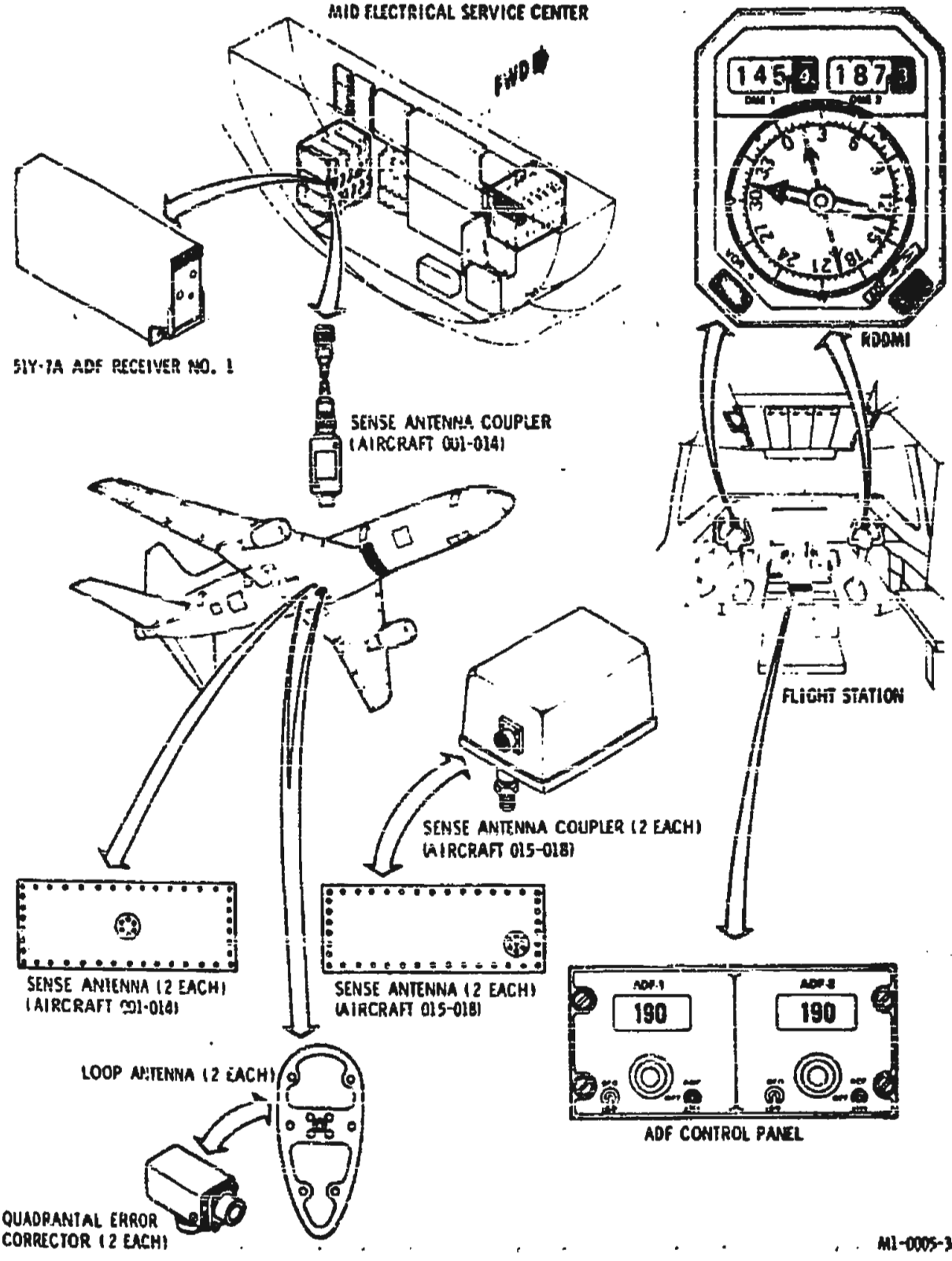
The ADF system is enabled by providing power to the ac and dc essential radio buses, closing the 26V AC NAV EXCITATION RDDMI-1 (K25) and the NO. 1 NAVIGATION ADF (D6) 28V dc circuit breakers on the pilots overhead circuit breaker panel, and moving the ADF-1 mode selector switch out of the OFF position.

The system may be operated in either the ADF or the ANT mode (Ref. Fig. 2).

A. ADF Mode

In the ADF mode, a signal is received by the loop antenna and connected through the quadrantal error corrector to the receiver.

The loop antenna consists of two mutually perpendicular loops. Each loop is terminated at a goniometer stator winding in the receiver. The stator windings set up a



Automatic Direction Finder (ADF) System
Figure 1

EFFECTIVITY: 001-018, 021, 022

magnetic field within the goniometer. The direction of the magnetic field is determined by the amplitudes and polarities of the signals induced into the stator windings. The directional magnetic field is coupled to the loop RF amplifier through the goniometer rotor.

The signal is amplified in the loop RF amplifier and applied to the balanced modulator. The balanced modulator output signal is a double-sideband, suppressed-carrier signal (two 135 Hz sidebands).

The signal received by the sense antenna is applied to the receiver RF amplifier, where it is combined with the balanced modulator output signal and amplified. This combined signal forms a phase-modulated output signal with a modulation frequency of 135 Hz. The phase of the output signal is determined by the direction and angular difference between the actual goniometer rotor position and the goniometer null position.

The signal is then amplified and coupled through bandpass filters to the first mixer, where it is mixed with the synthesizer output signal to produce a first IF frequency of 15 MHz.

The first IF (15 MHz) is applied to a 15 MHz crystal filter, and then mixed with an 18.6 MHz injection signal to produce a second IF frequency of 3.6 MHz. The second IF (3.6 MHz) is applied to a 3.6 MHz filter, amplified and then applied to a dual detector (phase and amplitude). The phase detector extracts the bearing information from the second IF and applies it to the receiver servo system. The amplitude detector extracts the audio, AGC, and detector lock information from the second IF.

The phase of the bearing information is compared in the receiver servo phase detector with the phase of the 135 Hz reference signal from the switching oscillator. The servo phase detector output signal is amplified and then used to drive the loop servo motor to null-out the goniometer rotor. The goniometer rotor position is then transmitted to both RDDMI No. 1 bearing pointers by the receiver bearing synchro.

The detected audio output signal is amplified and applied to the audio distribution unit (Ref. 23-51-00).

The amplitude detector dc output voltage is amplified and applied as an AGC control voltage to the AGC attenuator and the two IF amplifiers. This dc output voltage is also used to enable the muting circuit. The muting circuit disables the receiver audio output and bearing output circuits when

no signal is applied to the antenna, when the synthesizer is not locked-on, and when the receiver is being tuned.

B. ANT Mode

In the ANT mode, the receiver operates as an aural receiver only. When the mode switch is set to the ANT position, the receiver control logic circuit gates a signal to the indicator horizontal positioner circuit (in the receiver). The indicator horizontal positioner circuit then applies a 270 degree relative bearing signal to both RDDMI No. 1 bearing pointers. The control logic circuit also applies a disabling signal to the loop RF amplifier, blocking the loop antenna signals.

C. Tuning

The binary coded decimal (BCD) tuning information originates in the control panel (frequency selector switches) and determines the synthesizer first injection frequency which is applied to the first mixer. Frequency control information is also applied to the receiver band logic/audio muting subassembly. The band logic circuit decodes the BCD frequency information and provides band switching information to the loop RF amplifier, balanced modulator, and the bandpass filters. The audio muting circuit monitors the BCD control wires and generates a muting pulse when a frequency control line changes state. The muting pulse is applied to the control logic circuit to disable the receiver bearing information and audio output circuits. The control logic circuit also receives the ADF or ANT mode control signal from the control panel (mode selector switch) and sets the receiver to the selected mode of operation.

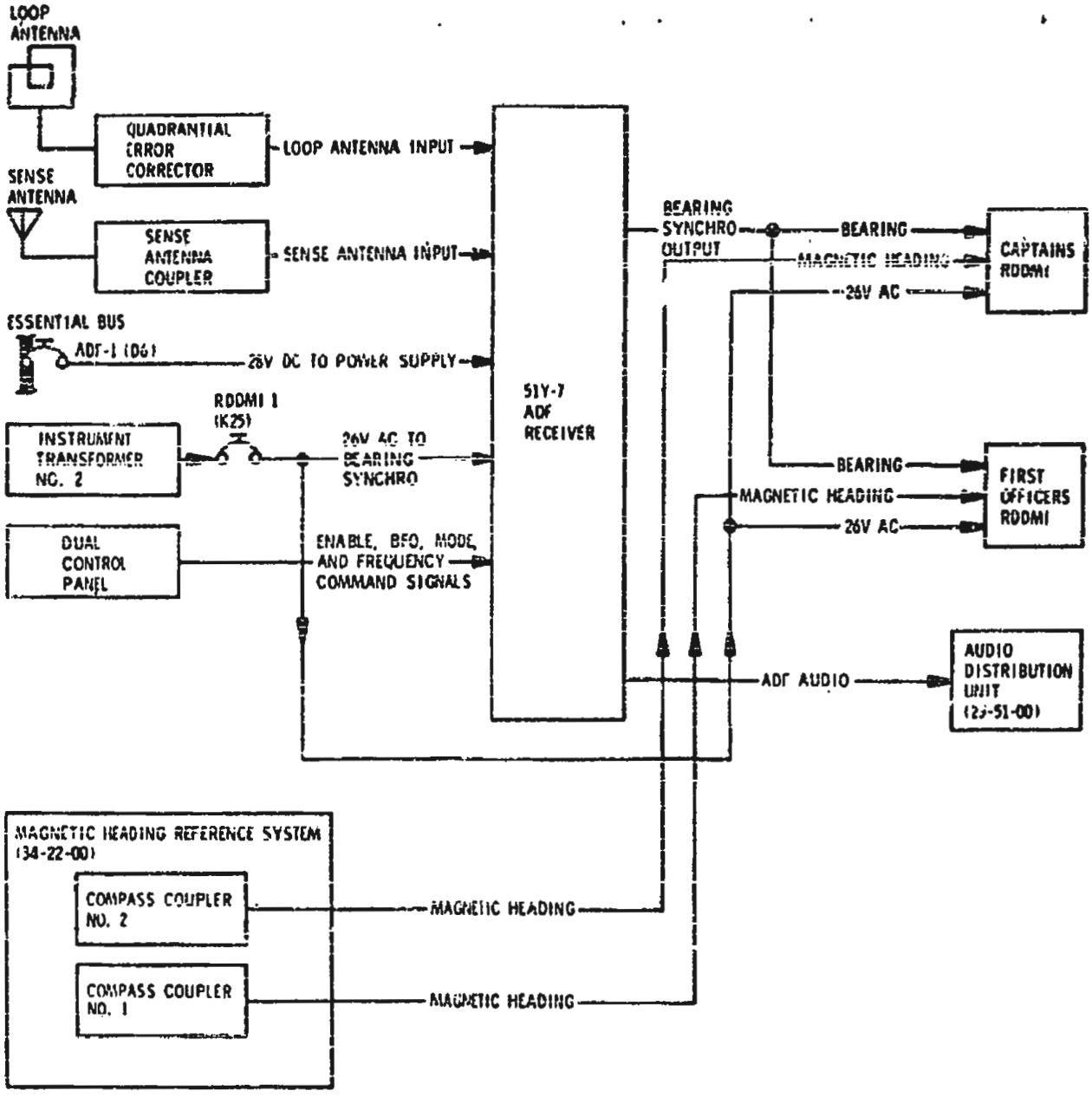
D. BFO/OFF Selector

The BFO/OFF selector switch is used for reception of cw signals. When set to the BFO position, the receiver tone generator is enabled and a 1020 Hz signal is generated to modulate the second IF (3.6 MHz). The tone generator is disabled when the switch is set to OFF.

3. 51Y-7 ADF Receiver

A. Description

The 51Y-7 ADF receiver receives and processes the signal from a selected radio station (190 to 1750 kHz). The processed data is applied to the No. 1 bearing pointers on both RDDMIs which then visually display the relative bearing



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R Automatic Direction Finder (ADF) System Block Diagram
R Figure 2

EFFECTIVITY: 001-018, 021, 022

to the selected station. The receiver audio output is applied to the audio distribution unit (Ref. 23-51-00).

The receiver is housed in a 1/4-ATR short case with a slide-on dust cover secured by a captive fastener. The receiver is constructed on a planar center board with parallel-mounted, plug-in assemblies on either side. The centerboard provides the interconnecting wiring between the plug-in assemblies and the rear connectors.

The receiver front panel contains a self test switch and a goniometer/synchro position indicator for use during self test.

B. Operation

The receiver provides two modes of operation: ANT and ADF (Ref. Fig. 3). In the ANT mode, the loop antenna circuits and the bearing servo system are disabled. The signal received by the sense antenna is applied to the receiver and processed to produce an audio output. In the ADF mode, a signal received by the loop antenna is applied to the receiver through the quadrantal error corrector. The signal received by the sense antenna is also applied to the receiver. The loop antenna and sense antenna input signals are combined and processed in the receiver to produce bearing and audio output information.

(1) ANT Mode

In the ANT mode, a signal received by the sense antenna is coupled to the receiver through the receiver sense antenna transformer. The input signal is amplified, then applied to a linearization circuit and a bandpass filter.

The bandpass filter consists of filter circuits which pass one of six frequency bands as commanded by a frequency band driver circuit. The frequency range of each band is:

Band One - 190 to 279.5 kHz

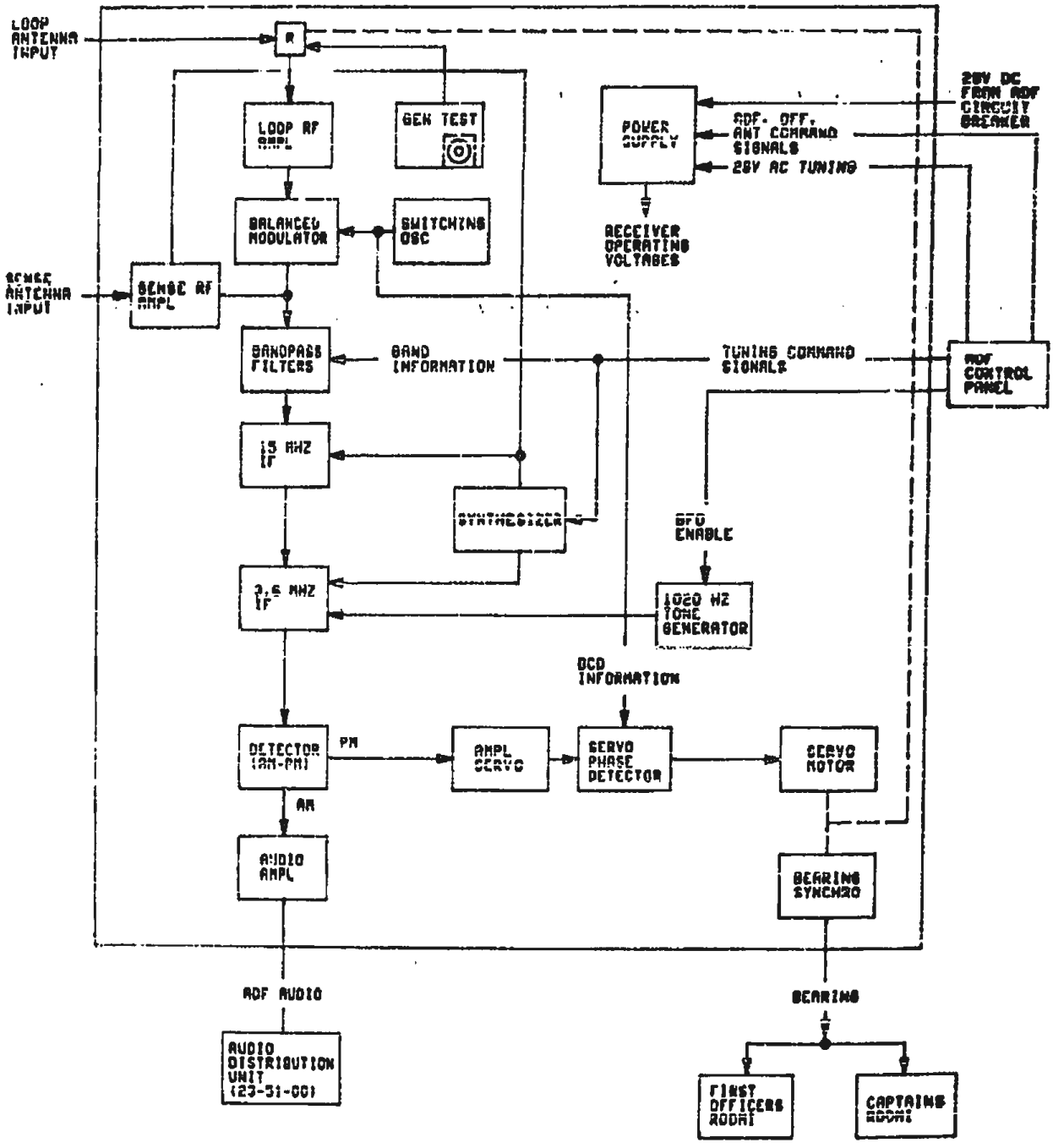
Band Two - 280 to 399.5 kHz

Band Three - 400 to 599.5 kHz

Band Four - 600 to 899.5 kHz

Band Five - 900 to 1399.5 kHz

Band Six - 1400 to 1749.5 kHz



51Y-7 ADF Receiver Block Diagram
Figure 3

The bandpass filter output signal is mixed with a variable synthesizer injection frequency signal in a balanced mixer. The balanced mixer output signal is the first IF (15 MHz). The 15 MHz IF is filtered, AGC attenuated (controlled) and amplified. The amplified first IF is then coupled to the second mixer, where it is mixed with a second synthesizer (fixed) injection frequency signal (18.6 MHz). The second mixer output becomes the second IF (3.6 MHz). The 3.6 MHz IF is then filtered, AGC attenuated and amplified.

When the BFO/OFF switch on the control panel is set to BFO, the 1020 Hz tone oscillator output signal is coupled with the amplified second IF (modulating it), allowing the reception of CW signals.

The amplified second IF is then applied to an audio detector for demodulation (audio output). The detected audio output signal is then amplified and fed to the audio distribution unit (Ref. 23-51-00). The receiver AGC voltage is also developed by the audio detector.

(2) ADF Mode

The fixed loop antenna consists of two mutually perpendicular loops. Each loop is terminated at a stator winding in the receiver goniometer. A signal received by the fixed loop antenna is regenerated with the same relative direction and magnitude in the stator windings of the goniometer. The stator windings are also perpendicular to each other. The directional signal is coupled by the goniometer rotor and loop transformer to phasing circuits.

The phasing circuits maintain a 90 degree phase difference between the loop and sense antenna signals. The phasing circuit output signals are amplified and applied to a balanced modulator.

In the balanced modulator, the loop signal phase (figure-eight pattern) is reversed at a rate set by a switching oscillator.

The balanced modulator output signal is applied to a summing transformer, where it is summed with the sense antenna input signal (the two signals are 90 degrees out of phase). The resultant phase angle output signal is the modulation angle. The size of the angle depends on the loop signal amplitude. This phase modulated signal is then coupled to the bandpass filter, previously described (ANT mode).

The second IF is applied to a phase modulation detector (and the audio detector previously described). The phase modulation detector output signal is applied to a synchronous filter, amplified and applied to a limiter and then to the servo phase detector. The limiter eliminates any AM modulation and ensures that the servo phase detector input signal has a constant amplitude.

The servo phase detector output signal is applied to the dc servo control circuit. The dc servo circuit controls a dc servo motor that is mechanically connected to the goniometer rotor and the bearing synchro transmitter. The polarity of the servo phase detector output signal controls the polarity of the dc servo control circuit output signal; thus controlling the direction of rotation of the servo motor.

When there is coupling between the goniometer rotor and stator windings, an error signal is applied to the receiver, resulting in an output signal to the servo motor. The servo motor then turns the goniometer rotor until no coupling exists (null). When the rotor is decoupled, no loop signal enters the receiver, and the servo motor stops. The position of the goniometer rotor is transmitted to both RDDMI NO. 1 bearing pointers by the bearing synchro transmitter (mechanically coupled to the servo motor and the goniometer rotor).

(3) Tuning

Frequency control of the receiver is accomplished by BCD (binary coded decimal) information from the control panel. The BCD frequency information is applied to an ARINC buffer and converted to logic levels.

When an input to a buffer stage is grounded in the control panel, the output of that stage is 5.0V dc (logic 1). If the input is open, the output of the stage is 0.0V dc (logic 0). The buffer output is then applied to the bandswitch logic circuits, the muting circuits, and to the synthesizer.

The buffer output logic 1 and logic 0 signals control pulse amplifiers (frequency band drivers) in the bandswitch logic circuit, which command which of the six frequency bands the bandpass filter will pass.

When the pulse amplifiers are conducting (tuning in process) the muting circuit is enabled, disabling the receiver audio and bearing output circuits.

The logic 1 and logic 0 signals control the variable synthesizer injection frequency. The variable synthesizer injection frequency (used to generate the first IF) is always 15 MHz plus whatever frequency is set on the control panel. The logic 1 and logic 0 signals control the frequency of a voltage controlled oscillator (VCO) to establish the variable first injection frequency.

(4) Power Supply

All receiver operating voltages are provided by an internal 27.5V dc power supply. The power supply provides +19V dc, ±13V dc, ±6V dc, +5.5V dc, and 26V dc for receiver operation.

4. ADF Control Panel

A. Description

The ADF control panel is mounted using four quarter-turn fasteners and contains six, 5V ac internally mounted panel lights and eight internally mounted dial lights for nighttime illumination.

The control panel is a dual unit (two sets of identical controls), divided into two sections placarded ADF-1 and ADF-2. Since the two sets of controls are identical, only one set is described.

The following ADF system operating controls and indicators are provided on the control panel:

BFO/OFF is a two-position toggle switch which enables the tone generator in the ADF receiver.

ADF/OFF/ANT is a three-position toggle switch used to enable and set the ADF receiver to the desired mode of operation.

A three-deck wafer switch (with a separate control for each deck with a digital readout window) is used to control the operating frequency of the ADF receiver.

5. ADF Sense Antenna

A. Description

The sense antenna provides the ADF system omnidirectional receiving capability. The antenna is a conductive coating

flame-sprayed over a ground plane on the skin of the aircraft (Ref. 51-50-10). The conductive surface of the antenna is connected to the ADF receiver through a lightning arrestor.

6. ADF Loop Antenna

A. Description

The ADF loop antenna is a one-piece sealed unit with a hermetically sealed connector.

The fixed-loop antenna consists of four ferrite-cored coils, two are parallel and two are perpendicular to the fore-aft line of the aircraft (Ref. Fig. 4). Each set of parallel coils is connected in parallel to provide additional gain.

The loop antenna provides the information necessary to determine the direction of the received radio signals. For each direction of incoming radio waves, there is a particular combination of voltages induced in the two sets of coils which signals from that direction only can induce.

7. Quadrantal Error Corrector

A. Description

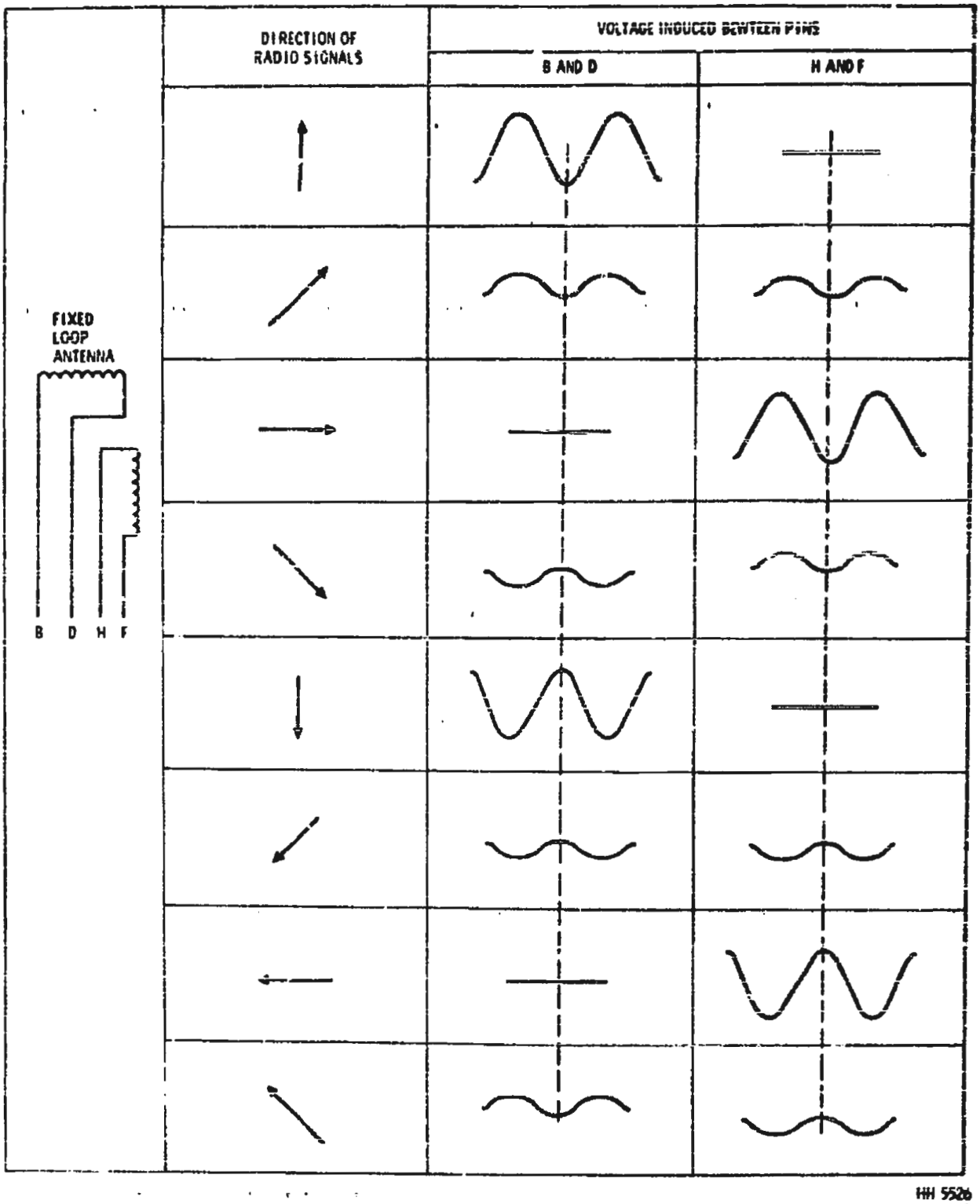
The quadrantal error corrector is enclosed in a foam-filled aluminum case, which is mounted on the loop antenna electrical connector.

The quadrantal error corrector is an inductance network that compensates for the effects of the metallic skin of the aircraft on the received radio waves (distortion). The loop antenna compensates partially to relieve this distortion. Additional compensation is obtained by applying the loop antenna output signal to the quadrantal error corrector. The quadrantal error corrector acts as a fixed attenuator which reduces one component of the signal from the loop antenna before applying the signal to the ADF receiver.

8. Loop Antenna Cable Assembly

A. Description

The loop antenna cable assembly connects the quadrantal error corrector output connector to the ADF receiver loop antenna input connector.



Phase and Magnitude Relationships of Induced Loop Antenna Voltages
Figure 4

The cable assembly consists of two electrical connectors and four coaxial cables surrounded by a protective covering.

9. Sense Antenna Cable Assembly

A. Description

The sense antenna cable assembly connects the sense antenna output connector to the sense antenna coupler antenna input connector.

The cable assembly consists of an electrical connector (sense antenna coupler input), a single coaxial cable, and a coaxial connector (sense antenna output).

10. Sense Antenna Coupler

A. Description

Sense Antenna Coupler (Aircraft 001-014)
the 179J-5 Sense Antenna Coupler matches the sense antenna impedance (50 pF) and the sense antenna cable impedance (220 pF) to the ADF receiver sense antenna input impedance (3000 pF). The sense antenna coupler consists of a wide-band RF transformer mounted in a foam-filled sealed metal chassis.

The sense antenna coupler is provided with an eighteen inch pendant cable (RCVR) to connect to the ADF receiver sense antenna input connector and a connector to connect with the aircraft sense antenna cable (ANT).

C Sense Antenna Coupler (Aircraft 015-018)
the 179J-16 Sense Antenna Coupler is a 300 pF in/2700 pF out impedance matching unit. The coupler combined with coupler-to-receiver cabling provides matching of the sense antenna impedance (300 pF) to the ADF receiver sense antenna input impedance (3000 pF).

The coupler consists of a wide-band RF transformer mounted in a foam-filled, sealed, metal chassis. A connector is provided on one side of the unit for cable connection to the ADF receiver, and an insulated feedthrough is provided on the underside of the unit for a jumper wire connection from the sense antenna.

10. Radio Digital Distance Magnetic Indicator (RDDMI)

A. Description and Operation

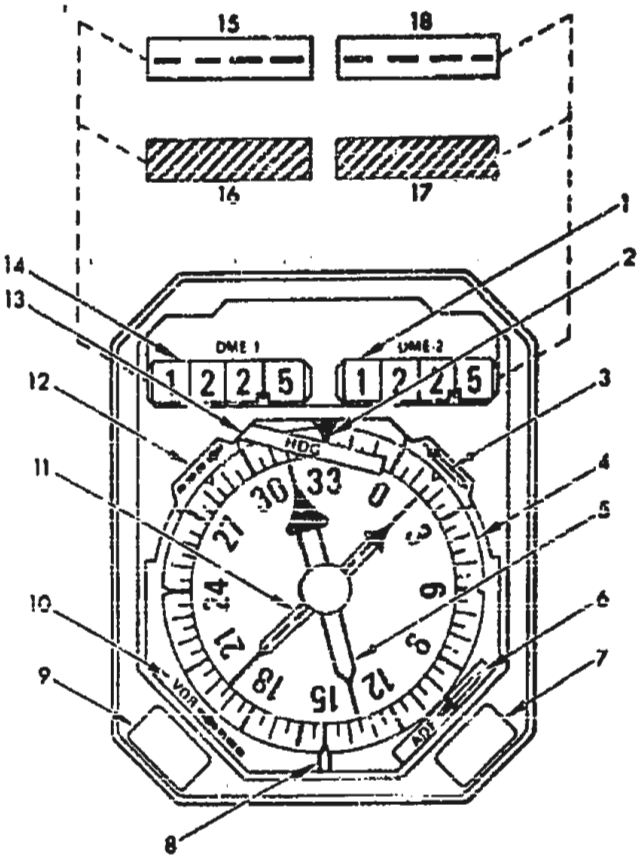
The RDDMI is a multiple display indicator with integral electronics, monitoring, and warning flags (Ref. Fig. 5). Power is applied to the RDDMI by closing circuit breakers NO. 1 NAV & INSTR F/O RDDMI (E3), NO. 2 NAV & INSTR CAPT RDDMI (E20), 26 VAC NAV EXCITATION RDDMI-1 (K25) and 26 VAC NAV EXCITATION RDDMI-2 (J20) on the pilots overhead circuit breaker panel CB1, zone 210. Magnetic heading information is displayed on a rotating compass card driven by the magnetic heading reference system (MHRS) (Ref. 34-22-00). Heading information displayed on the Captains RDDMI is provided by MHRS No. 2, and the heading information displayed on the First Officers RDDMI is provided by MHRS No. 1.

The VOR/ADF pointer No. 1 (single dashed line arrow) provides bearing information from the No. 1 VOR system (Ref. 34-55-00), or the ADF system , as selected on the switches provided on the bottom of the RDDMI. The VOR/ADF pointer No. 2 (double line arrow) provides bearing information from the No. 2 VOR system only (the ADF switch position is not used with pointer No. 2). The VOR and ADF displays are magnetic bearing to the selected VOR station and relative bearing to the selected (tuned) ADF station.

The two switches located on the bottom right and left corners of the RDDMI, control the selection of the information to be displayed on the two pointers (pointer No. 1, pointer No. 2). The left switch controls pointer No. 1, and the right switch controls pointer No. 2. The switches actuate annunciators consisting of VOR and ADF legends and pointer symbols, which indicate the mode selected and the pointer displaying the selected information.

When a VOR ground station frequency (108.00 MHz to 117.95 MHz) is selected on the Captains or First Officers VHF NAV control panel, the selected DME interrogator (Ref. 34-51-00) transmits interrogation pulses to the selected ground station. The ground station replies to the DME interrogation signal on an associated beacon transmitting frequency. The beacon reply signals are applied to the selected DME interrogator, and the interrogator computes the elapsed time between the interrogation and the reply to determine the distance to the station. The measured distance is then displayed on the RDDMI, as either DME-1, or DME-2 nautical mileage (Ref. Fig. 6).

If no computed distance is applied to the RDDMI from the selected DME interrogator, four dashed-lines are displayed in the applicable mileage counter (DME-1, or DME-2) on the RDDMI. If either the computed data from the selected DME interrogator, or the mileage counter circuit within the RDDMI is erroneous or malfunctions [as determined by the



1	DISTANCE NO. 2 DISPLAY	10	DASHED LINE POINTER ANNUNCIATOR
2	HEADING INDEX	11	VOR ADF BEARING POINTER - DASHED LINE
3	VOR FAIL FLAG - DOUBLE LINE POINTER	12	VOR FAIL FLAG - DASHED LINE POINTER
4	HEADING DIAL	13	HEADING WARNING FLAG
5	VOR ADF BEARING POINTER - DOUBLE LINE	14	DISTANCE NO. 1 DISPLAY
6	DOUBLE LINE POINTER ANNUNCIATOR	15	DME-1 NO COMPUTED DATA SHUTTER
7	VOR ADF SELECTOR - DOUBLE LINE POINTER	16	DME-1 FAIL SHUTTER
8	RECIPROCAL HEADING INDEX	17	DME-2 FAIL SHUTTER
9	VOR ADF SELECTOR - DASHED LINE POINTER	18	DME-2 NO COMPUTED DATA SHUTTER

M1-45900-34-2105

Radio Digital Distance Magnetic Indicator
Figure 5

R EFFECTIVITY: 001-018, 021, 022
R

data valid monitor circuit within the RDDMI, the applicable milage counter on the RDDMI is covered by a warning flag.

Flags are also provided to warn of indicator malfunctions and loss of MHRS, or VOR system indicator inputs. A HDG flag appears at the top-center of the compass card to warn of any of the following conditions:

Loss of primary power

Excessive servo null voltage (indicating an error in the displayed heading information)

Open circuit in control transformer null winding

Loss of magnetic heading input

Loss of external 28 volts dc data valid signal (magnetic heading data valid signal input)

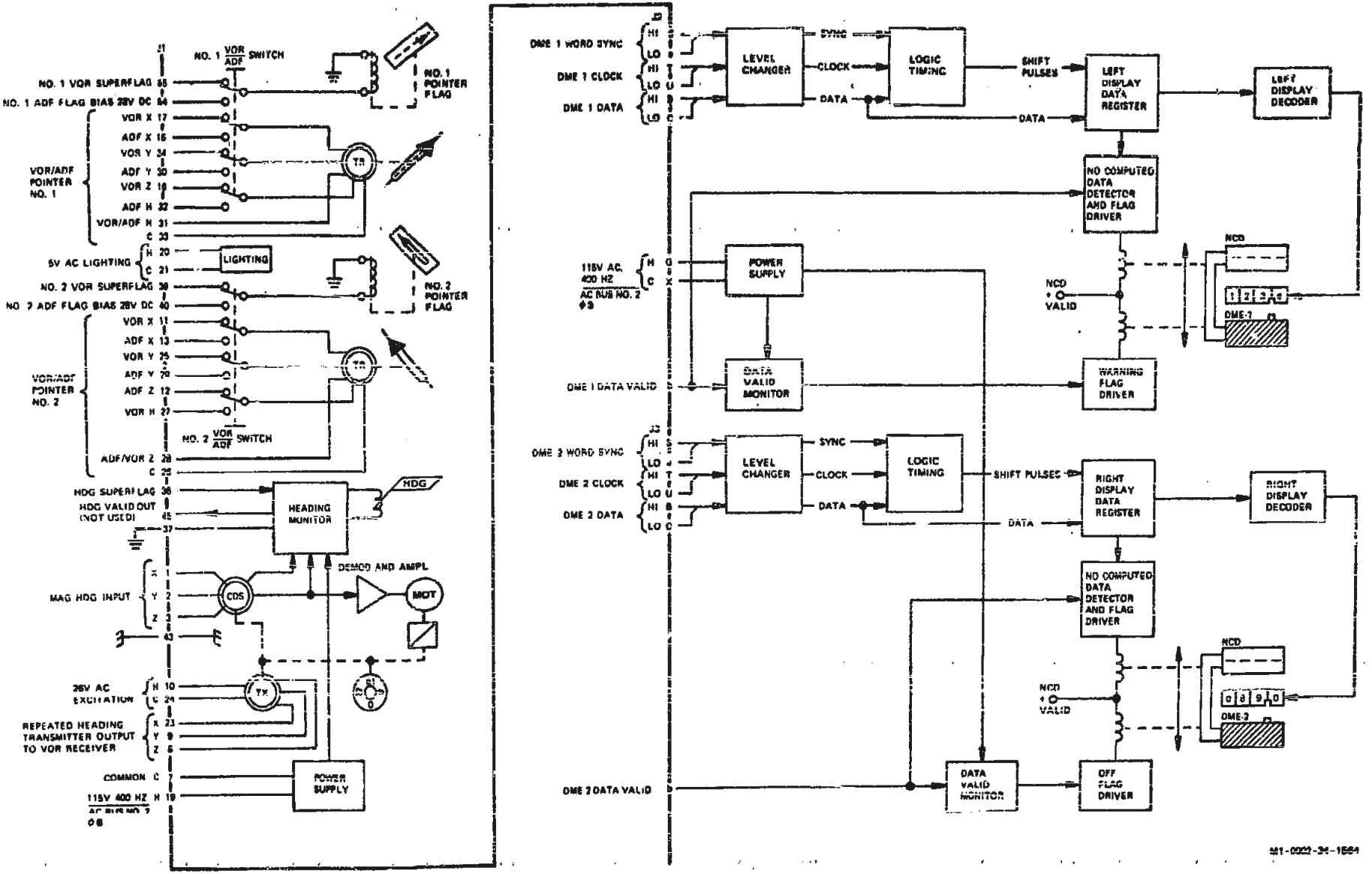
If the VOR input is selected for either pointer display, and the data valid signal from the VOR receiver is present, the VOR warning flag (VOR-1, or VOR-2) will be out of view. Loss of the data valid signal causes the applicable VOR warning flag to be displayed.

NOTE: When a localizer frequency is selected on the VHF NAV control panel, a fabricated VOR data valid signal is applied to the RDDMI from the VHF NAV accessory unit, inhibiting the VOR warning flag.

When the ADF input is selected for display on the pointer, an externally supplied 28 volts dc signal is applied to the VOR warning flag solenoids, which holds the warning flags out of view.

NOTE: No warning flag is provided for ADF operation.

Since no ADF signal is provided for RDDMI pointer No. 2, selection of ADF to be displayed on pointer No. 2, causes the VOR-2 warning flag to be out of view.



Radio Digital Distance Magnetic Indicator Simplified Schematic Diagram
Figure 6

R EFFECTIVITY: 001-018, 021, 022
R

0028

C C # AUTOMATIC DIRECTION FINDER (ADF) SYSTEM DESCRIPTION AND OPERATION

C 1. General

C The ADF System (Ref. Fig. 1) consists of the following:

CR Two 51Y-7 receivers

C A dual control panel

C Two radio digital distance magnetic indicators (RDDMI)

C Two 137A-6 loop antennas

C Two sense antennas

C Two 582(-C) Quadrantal Error Correctors

C Two 179J-16 sense antenna couplers

C The receivers are located in the mid electrical service center C (MESC), zone 137. The dual control panel is located on the C pilots center console, zone 210. The RDDMIs are located on the C Captains and First Officers instrument panels, zone 210. The C antennas are flush-mounted to the fuselage bottom-centerline at C FS 1043, zone 143. The error correctors are mounted on each C loop antenna. The sense antenna couplers and lightning C arrestors are located in the MLG fairing area above each sense CR antenna, zone 143. Each of four audio selector panels (Ref. C 23-51-00) located in the flight station provides two C ON-OFF/volume controls for the ADF system audio. The controls C are placarded 1-ADF-2.

CR The control panel is a dual unit (placarded ADF-1 and ADF-2) CR containing frequency selectors, digital frequency readout CR windows, and BFO/OFF switches.

C Each loop antenna consists of two mutually perpendicular loops CR providing ADF system directional receiving capability. The loop C antennas are mounted on the bottom of the aircraft fuselage with C one loop aligned with the fuselage longitudinal axis (fore-aft) C and the other loop aligned with the aircraft transverse axis C (wingtip-to-wingtip).

CR The error corrector neutralizes loop antenna electromagnetic C field distortion caused by the aircraft structure, eliminating C induced bearing readout errors. The amount of induced bearing C error is the same in each quadrant (quadrantal error); and the

C error corrector acts as a fixed attenuator to null-out this
C induced bearing error.

CR The sense antennas provide ADF system omnidirectional receiving
C capability. Each antenna consists of a conductive coating flame
C sprayed over a ground plane on the skin of the aircraft
CR (fuselage-bottom). The sense antenna coupler matches sense
C antenna impedance (300 pf) to the ADF receiver sense antenna
C input impedance (3000 pf).

C The RDDMIs each contain two VOR/ADF switches, one controlling
C pointer No. 1 and the other pointer No. 2. The No. 1 ADF
C bearing information is indicated by pointer No. 1 (single dashed
C line arrow) when the left VOR/ADF switch is in the ADF position
C and the No. 2 ADF bearing is indicated by pointer No. 2 (double
C line arrow) when the right VOR/ADF switch is in the ADF
C position.

C Each receiver acquires and processes the signal from a selected
C radio station. This data is applied to the RDDMI which visually
CR displays relative bearing to the station. The receiver audio
C output is applied to the audio distribution unit (Ref.
C 23-51-00).

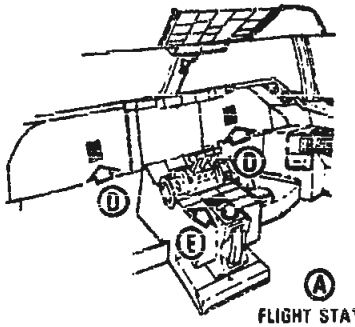
C 2. Operation

C ADF system No. 1 (Ref. Fig. 2) is enabled by providing power to
C the dc essential radio bus and instrument transformer No. 2,
C closing the NO. 1 NAVIGATION - ADF (D6) and 26 VAC NAV
C EXCITATION - RDDMI NO. 1 (K25) circuit breakers on the pilots
C overhead circuit breaker panel CB1, zone 210 and placing the
C ADF-1 mode selector switch on the ADF control panel out of the
C OFF position. This allows 28V dc to be applied to ADF receiver
C No. 1, and 26V ac, 400-Hz, Phase A to be applied to ADF receiver
C No. 1 bearing synchro and bearing pointer No. 1 synchro of both
C RDDMIs for excitation.

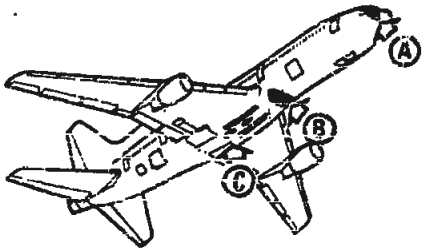
C ADF system No. 2 is enabled by providing power to the No. 2
C radio bus and instrument transformer No. 3, closing the NO. 2
C NAVIGATION - ADF (D24) and 26 VAC NAV EXCITATION - RDDMI 2 (J20)
C circuit breakers on CB1, and placing the ADF-1 mode selector
C switch on the ADF control panel out of the OFF position. This
C allows 28V dc to be applied to ADF receiver No. 2, and 26V ac,
C 400-Hz, Phase B to be applied to ADF receiver No. 2 bearing
C synchro and bearing pointer No. 2 synchro of both RDDMIs for
C excitation.

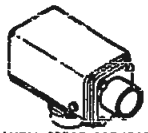
CR The system may be operated in either ADF or ANT mode (Ref. Fig.
C 2).

C A. ADF Mode

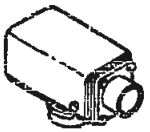


Ⓐ FLIGHT STATION
ZONE 210

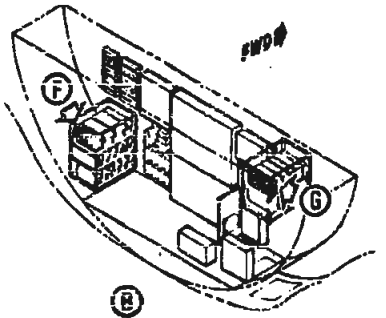




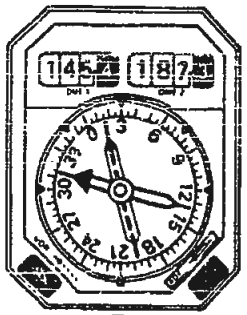
QUADRANTAL ERROR CORRECTOR NO. 1
(MOUNTED ON LOOP ANTENNA
ELECTRICAL CONNECTOR)



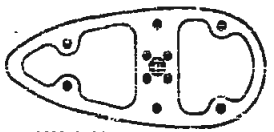
QUADRANTAL ERROR CORRECTOR NO. 2
(MOUNTED ON LOOP ANTENNA
ELECTRICAL CONNECTOR)



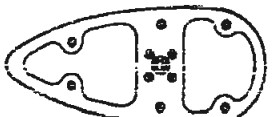
Ⓑ MID ELECTRICAL SERVICE CENTER
ZONE 137



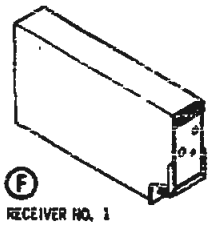
Ⓖ RDDMI
(2-CAPTAIN AND FIRST OFFICER)



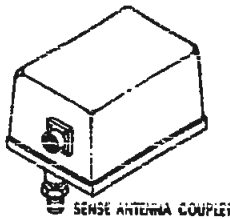
LOOP ANTENNA NO. 1 (FS 1103)



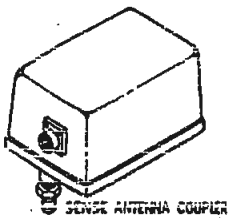
LOOP ANTENNA NO. 2 (FS 1169)



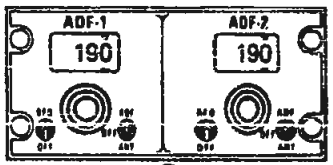
Ⓕ 51Y-7A ADF RECEIVER NO. 1



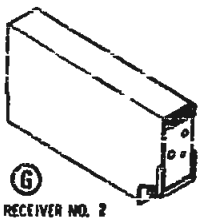
SENSE ANTENNA COUPLER NO. 1
(BBL 42.5, FS 1150)



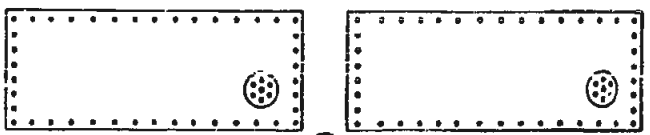
SENSE ANTENNA COUPLER NO. 2
(BBL 42.5, FS 1150)



Ⓔ ADF CONTROL PANEL



Ⓖ 51Y-7A ADF RECEIVER NO. 2



SENSE ANTENNA NO. 1 (BBL 42.5, FS 1043)

SENSE ANTENNA NO. 2 (BBL 42.5, FS 1061)

Ⓒ ANTENNA COMPONENTS
(ZONE 163)

M2-70000-34-1602

C Automatic Direction Finder (ADF) System
C Figure 1

R EFFECTIVITY: 019, 020, 023-999
R

005B

CR In ADF mode, a signal is received by the loop antenna and
C connected through the quadrantal error corrector to the
C receiver.

C The loop antenna consists of two mutually perpendicular
C loops. Each loop is terminated at a goniometer stator
C winding in the receiver. The stator windings set up a
C magnetic field within the goniometer. The direction of the
C magnetic field is determined by the amplitudes and
C polarities of the signals induced into the stator windings.
C The directional magnetic field is coupled to the loop RF
C amplifier through the goniometer rotor.

C The signal is amplified in the loop RF amplifier and applied
C to the balanced modulator. The balanced modulator output
C signal is a double-sideband, suppressed-carrier signal (two
C 135-Hz sidebands).

C The signal received by the sense antenna is applied to the
C receiver RF amplifier, where it is combined with the
C balanced modulator output signal and amplified. This
C combined signal forms a phase-modulated output signal with a
C modulation frequency of 135-Hz. The phase of the output
C signal is determined by the direction and angular difference
C between the actual goniometer rotor position and the
C goniometer null position.

C The signal is then amplified and coupled through bandpass
C filters to the first mixer, where it is mixed with the
C synthesizer output signal to produce a 15-MHz first IF.

C The 15-MHz is applied to a 15-MHz crystal filter and mixed
C with an 18.6-MHz injection signal to produce a 3.6-MHz
C second IF. The 3.6-MHz IF is applied to a 3.6-MHz filter,
C amplified and applied to a dual detector (phase and
C amplitude). The phase detector extracts the bearing
C information from the second IF and applies it to the
C receiver servo system. The amplitude detector extracts the
C audio, AGC, and detector lock information from the second
C IF.

C The phase of the bearing information is compared in the
C receiver servo phase detector with the phase of the 135-Hz
C reference signal from the switching oscillator. The servo
C phase detector output signal is amplified and used to drive
C the loop servo motor to null-out the goniometer rotor. The
C goniometer rotor position is then transmitted to the RDDMI
C bearing pointers by the receiver bearing synchro.

C The detected audio output signal is amplified and applied to
C the audio distribution unit (Ref. 23-51-00).

C The amplitude detector dc output voltage is amplified and
C applied as an AGC control voltage to the AGC attenuator and
C the two IF amplifiers. This dc output voltage is also used
C to enable the muting circuit. The muting circuit disables
C the receiver audio output and bearing output circuits when
C no signal is applied to the antenna, when the synthesizer is
C not locked-on, and when the receiver is being tuned.

CR B. ANT ModeIn ANT mode, the receiver operates as an aural
CR receiver only. When the mode switch is set to ANT position,
CR the receiver control logic circuit gates a signal to the
CR indicator horizontal positioner circuit (in the receiver).
CR The indicator horizontal positioner circuit applies either a
CR 90-degree or 270-degree bearing signal to the RDDMI bearing
C pointers. The control logic circuit also applies a
C disabling signal to the loop RF amplifier blocking the loop
C antenna signals.

C C. Tuning

C The binary coded decimal (BCD) tuning information originates
C in the control panel (frequency selector switches) and
C determines the synthesizer first injection frequency which
C is applied to the first mixer. Frequency control
C information is also applied to the receiver band logic/audio
C muting subassembly. The band logic circuit decodes the BCD
C frequency information and provides band switching
C information to the loop RF amplifier, balanced modulator,
C and the bandpass filters. The audio muting circuit monitors
C the BCD control wires and generates a muting pulse, when a
C frequency control line changes state, the muting pulse is
C applied to the control logic circuit to disable the receiver
C bearing information and audio output circuits. The control
CR logic circuit also receives ADF or ANT mode control signals
C from the control panel (mode selector switch) and sets the
C receiver to the selected mode of operation.

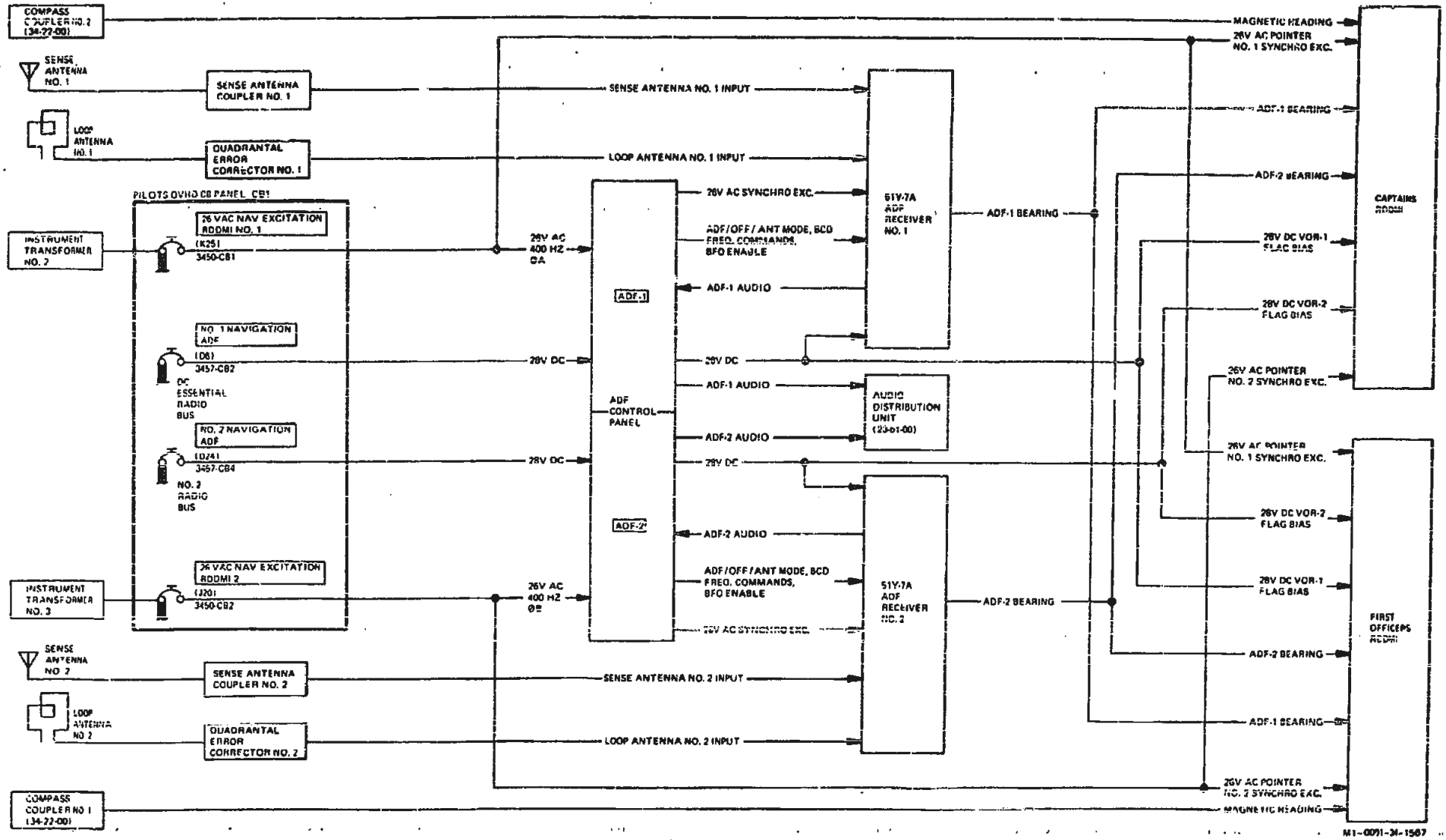
C D. BFO/OFF Selector

C The BFO/OFF selector switch is used for reception of CW
CR signals. When set to BFO position, the receiver tone
C generator is enabled and a 1020-Hz signal is generated to
C modulate the 3.6-MHz second IF. The tone generator is
C disabled when the switch is set to OFF.

C 3. ADF Receiver

C A. Description

C The ADF receiver receives and processes the signal from a
CR selected radio station (190-to 1750-kHz). The processed


COMPASS COUPLER NO. 2 (34-22-00)
SENSE ANTENNA NO. 1
SENSE ANTENNA COUPLER NO. 1
LOOP ANTENNA NO. 1
QUADRANTAL ERROR CORRECTOR NO. 1
PILOTS OVHD CB PANEL CB1
INSTRUMENT TRANSFORMER NO. 2
26 VAC NAV EXCITATION RODMI NO. 1 (K25) 3450-CB1
NO. 1 NAVIGATION ADF (D6) 3457-CB2
DC ESSENTIAL RADIO BUS
NO. 2 NAVIGATION ADF (D74) 3457-CB4
NO. 2 RADIO BUS
INSTRUMENT TRANSFORMER NO. 3
26 VAC NAV EXCITATION RODMI 2 (J20) 3450-CB2
SENSE ANTENNA NO. 2
SENSE ANTENNA COUPLER NO. 2
LOOP ANTENNA NO. 2
QUADRANTAL ERROR CORRECTOR NO. 2
COMPASS COUPLER NO. 1 (34-22-00)
SENSE ANTENNA NO. 1 INPUT
LOOP ANTENNA NO. 1 INPUT
26V AC 400 HZ 0A
26V DC
26V AC 400 HZ 0B
ADF CONTROL PANEL
ADF-1
ADF-2
26V AC SYNCHRO EXC.
ADF/OFF/ANT MODE, BCD FREQ. COMMANDS, BFO ENABLE
ADF-1 AUDIO
ADF-2 AUDIO
51Y-7A ADF RECEIVER NO. 1
51Y-7A ADF RECEIVER NO. 2
AUDIO DISTRIBUTION UNIT (23-01-00)
ADF-1 BEARING
ADF-2 BEARING
SENSE ANTENNA NO. 2 INPUT
LOOP ANTENNA NO. 2 INPUT
MAGNETIC HEADING
26V AC POINTER NO. 1 SYNCHRO EXC.
26V DC VOR-1 FLAG BIAS
26V DC VOR-2 FLAG BIAS
26V AC POINTER NO. 2 SYNCHRO EXC.
CAPTAINS RODMI
FIRST OFFICERS RODMI
M1-0091-34-1587

CR Automatic Direction Finder (ADF) System Block Diagram
CR Figure 2

EFFECTIVITY: 019, 020, 023-999

CR data is applied to the RDDMIs which visually display
C relative bearing to the selected station. The receiver
C audio output is applied to the audio distribution unit (Ref.
C 23-51-00).

C The receiver is housed in a 1/4-ATR short case with a
C slide-on dust cover secured by a captive fastener. The
C receiver is constructed on a planar center board with
C parallel-mounted, plug-in assemblies on either side. The
CR centerboard provides the interconnecting wiring between
CR plug-in assemblies and rear connectors. the rear
C connectors.

C The receiver front panel contains a self test switch and a
C goniometer/synchro position indicator for use during self
C test.

C B. Operation

C The receiver provides two modes of operation; ANT and ADF
CR (Ref. Fig. 3). In ANT mode, the loop antenna circuits and
CR bearing servo system are disabled. The signal received by
CR the sense antenna is applied to the receiver and processed
CR to produce an audio output. In ADF mode, a a signal
C received by the loop antenna is applied to the receiver
C through the quadrantal error corrector. The signal received
C by the sense antenna is also applied to the receiver. The
C loop antenna and sense antenna input signals are combined
C and processed in the receiver to produce bearing and audio
C output information.

CR In ANT mode, a signal received by the sense antenna is
C coupled to the receiver through the receiver sense antenna
C transformer. The input signal is amplified by an FET (field
C effect transistor), then applied to a linearization circuit
C and a bandpass filter.

C The bandpass filter consists of filter circuits which pass
C one of six frequency bands as commanded by a frequency band
C driver circuit. The frequency range of each band is:

CR Band One = 190-to 279.5-kHz

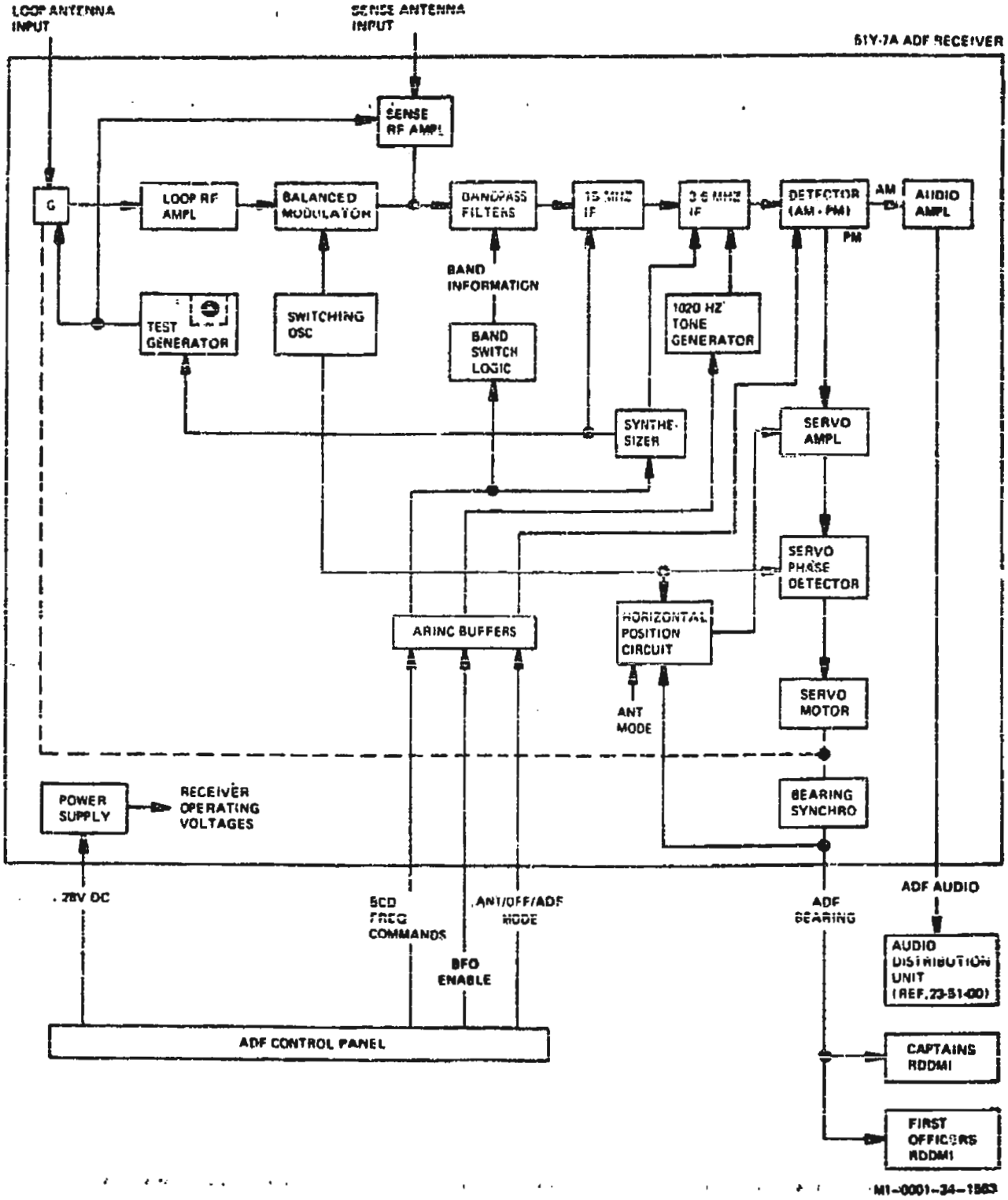
CR Band Two = 280-to 399.5-kHz

CR Band Three = 400-to 599.5-kHz

CR Band Four = 600-to 899.5-kHz

CR Band Five = 900-to 1399.5-kHz

CR Band Six = 1400-to 1749.5-kHz



C
C ADF Receiver, Block Diagram
Figure 3

R EFFECTIVITY: 019, 020, 023-999
R

C The bandpass filter output signal is mixed with a variable
C synthesizer injection frequency signal in a balanced mixer.
C The balanced mixer output signal is the first IF (15-MHz).
C The 15-MHz IF is filtered, AGC attenuated (controlled) and
C amplified. The amplified first IF is then coupled to the
C second mixer, where it is mixed with a second synthesizer
C (fixed) injection frequency signal (18.6-MHz). The second
C mixer output becomes the second IF (3.6-MHz). The 3.6-MHz
C IF is then filtered, AGC attenuated and amplified as was the
C first IF.

C When the BFO/OFF switch on the control panel is set to BFO,
C the 1020-Hz tone oscillator output signal is coupled with
CR the amplified second IF (modulating it), allowing reception
CR of CW signals.

CR The amplified second IF is applied to an audio detector for
CR demodulation (audio output). The detected audio output
CR signal is amplified and fed to the audio distribution unit
CR (Ref. 23-51-00). The receiver AGC voltage is developed by
C the audio detector.

C (2) ADF Mode

C The fixed loop antenna consists of two mutually
C perpendicular loops. Each loop is terminated at a
C stator winding in the receiver goniometer. A signal
C received by the fixed loop antenna is regenerated with
C the same relative direction and magnitude in the stator
C windings of the goniometer. The stator windings are
C also perpendicular to each other. The directional
C signal is coupled by the goniometer rotor and loop
C transformer to phasing circuits.

C The phasing circuits maintain a 90-degree phase
CR difference between loop and sense antenna signals. The
C phasing circuit output signals are amplified and
C applied to a balanced modulator.

C In the balanced modulator, the loop signal phase
C (figure-eight pattern) is reversed at a rate set by a
C switching oscillator.

C The balanced modulator output signal is applied to a
C summing transformer, where it is summed with the sense
C antenna input signal (the two signals are 90-degrees
C out of phase). The resultant phase angle output signal
C is the modulation angle. The size of the angle depends
C on the loop signal amplitude. This phase modulated
C signal is then coupled to the bandpass filter,
C previously described (ANT mode).

C The second IF is applied to a phase modulation detector
C (and the audio detector previously described). The
C phase modulation detector output signal is applied to a
C synchronous filter, amplified and applied to a limiter
C and then to the servo phase detector. The limiter
CR eliminates any AM modulation and ensures the servo
C phase detector input signal has a constant amplitude.

C The servo phase detector output signal is applied to
C the dc servo control circuit. The dc servo circuit
C controls a dc servo motor that is mechanically
C connected to the goniometer rotor and the bearing
C synchro transmitter. The polarity of the servo phase
C detector output signal controls the polarity of the dc
C servo control circuit output signal; thus controlling
C the direction of rotation of the servo motor.

C When there is coupling between the goniometer rotor and
C stator windings, an error signal is applied to the
C receiver, resulting in an output signal to the servo
C motor. The servo motor then turns the goniometer rotor
C until no coupling exists (null). When the rotor is
C decoupled, no loop signal enters the receiver, and the
C servo motor stops. The position of the goniometer
C rotor is transmitted to the RDDMI bearing pointer by
C the bearing synchro transmitter (mechanically coupled
C to the servo motor and the goniometer rotor).

C (3) Tuning

C Frequency control of the receiver is accomplished by
C BCD (binary coded decimal) information from the control
C panel. The BCD frequency information is applied to an
C ARINC buffer and converted to logic levels.

C When an input to a buffer stage is grounded in the
C control panel, the output of that stage is 5.0V dc
C (logic 1). If the input is open, the output of the
C stage is 0.0V dc (logic 0). The buffer output is then
C applied to the bandswitch logic circuits, the muting
C circuits, and to the synthesizer.

C The buffer output logic 1 and logic 0 signals control
C pulse amplifiers (frequency band drivers) in the
C bandswitch logic circuit, that select which of the six
C frequency bands the bandpass filter will pass.

C When the pulse amplifiers are conducting (tuning in
CR process) the muting circuit is enabled, disabling
C receiver audio and bearing output circuits.

C The logic 1 and logic 0 signals control the variable
C synthesizer injection frequency. The variable
C synthesizer injection frequency (used to generate the
C first IF) is always 15-MHz plus whatever frequency is
C set on the control panel. The logic 1 and logic 0
C signals control the frequency of a VCO (voltage
C controlled oscillator) to establish the variable first
C injection frequency.

C (4) Power Supply

C All receiver operating voltages are provided by an
C internal 27.5V dc power supply. The power supply
C provides +19V dc, ±13V dc, ±6V dc, +5.5V dc, and 26V ac
C for receiver operation.

C 4. ADF Control Panel

C A. Description

C The ADF control panel contains six, 5V ac internally mounted
C panel lights and eight internally mounted dial lights for
C nighttime illumination. The control panel is a dual unit
C (two sets of identical controls), divided into two sections
C placarded ADF-1 and ADF-2. Since the two sets of controls
C are identical only one set is described.

C The following ADF system operating controls and indicators
C are provided on the control panel:

C BFO/OFF is a two-position toggle switch used to enable
C the tone generator in the ADF receiver.

C ADF/OFF/ANT is a three-position toggle switch used to
C enable and set the ADF receiver to the desired mode of
C operation.

C A three-deck wafer switch (with a separate control for
C each deck with a digital readout window) is used to
C control the operating frequency of the ADF receiver.
C The window above each frequency switch indicates the
C frequency to which the receiver is tuned.

C 5. ADF Sense Antenna

C A. Description

CR The sense antenna provides ADF system omnidirectional
C receiving capability. The antenna is a conductive coating
C flame-sprayed over a ground plane on the skin of the

C aircraft (Ref. 51-50-10). The conductive surface of the
C antenna is connected to the ADF receiver through a lightning
C arrestor.

C 6. ADF Loop Antenna

C A. Description

C The ADF loop antenna is a one-piece sealed unit with a
C hermetically sealed connector.

C The fixed-loop antenna consists of four ferrite-cored coils,
C two are parallel and two are perpendicular to the fore-aft
C line of the aircraft (Ref. Fig. 4). Each set of parallel
C coils is connected in parallel to provide additional gain.

CR The loop antenna provides information necessary to determine
CR direction of received radio signals. For each direction of
C incoming radio waves, there is a particular combination of
C voltages induced in the two sets of coils which signals from
C that direction only can induce.

C 7. Quadrantal Error Corrector

C A. Description

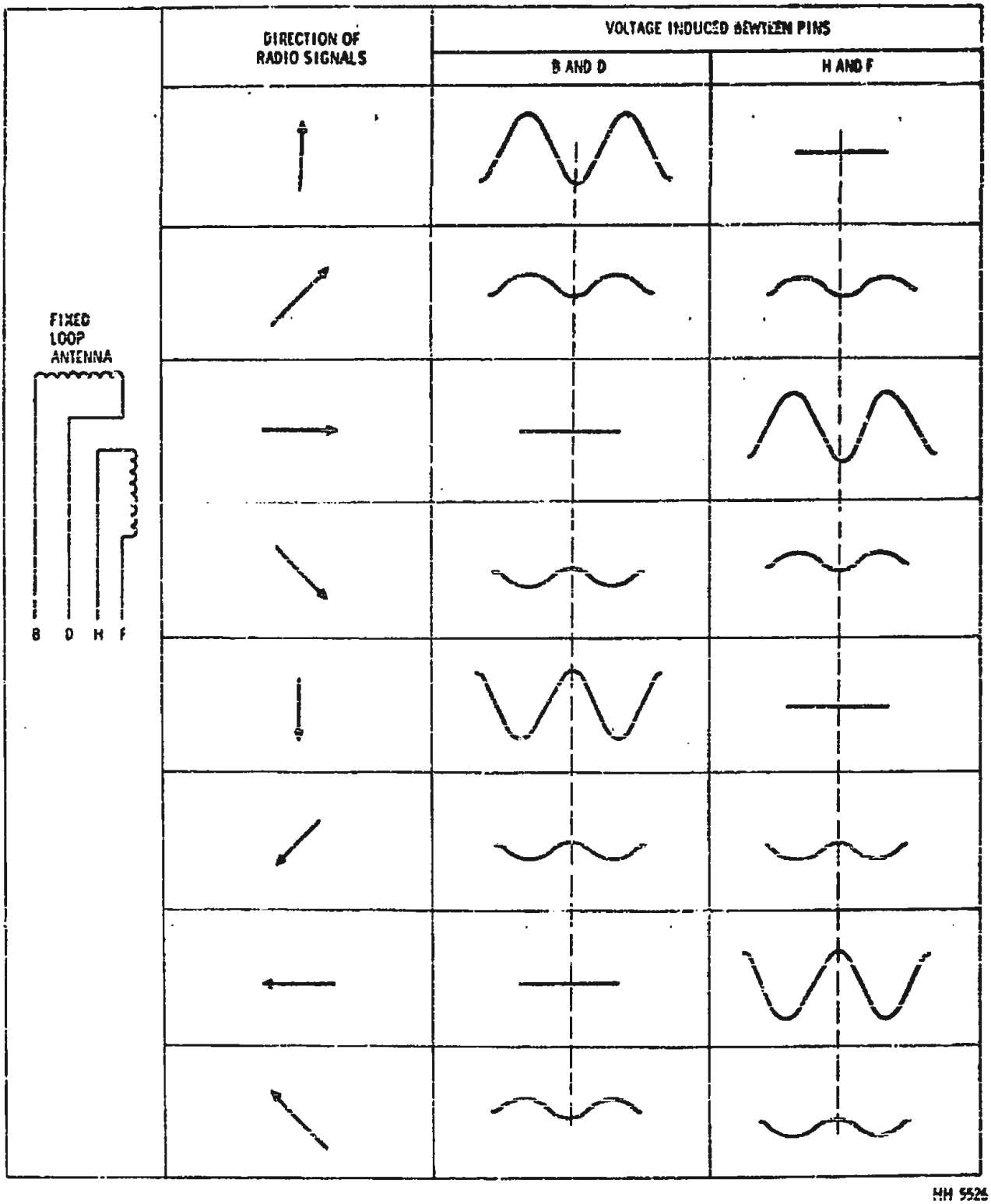
C The quadrantal error corrector is enclosed in a foam-filled
C aluminum case, which is mounted on the loop antenna
C electrical connector.

C The quadrantal error corrector is an inductance network that
CR compensates for influences of the metallic skin of the
C aircraft on the received radio waves (distortion). The loop
C antenna compensates partially to relieve this distortion.
C Additional compensation is obtained by applying the loop
C antenna output signal to the quadrantal error corrector.
C The quadrantal error corrector acts as a fixed attenuator
C which reduces one component of the signal from the loop
C antenna before applying the signal to the ADF receiver.

C 8. Loop Antenna Cable Assembly

C A. Description

C The loop antenna cable assembly connects the quadrantal
C error corrector output connector to the ADF receiver loop
C antenna input connector.



C Phase and Magnitude Relationships of Induced Loop Antenna Voltages
C Figure 4

C The cable assembly consists of two electrical connectors and
C four coaxial cables surrounded by a protective covering.

C 9. Sense Antenna Coupler

C A. Description

C The 179J-16 Sense Antenna Coupler is a 300pF in/2700pF out
C impedance matching unit. The coupler combined with
C coupler-to-receiver cabling provides matching of the sense
C antenna impedance (300pF) to the ADF receiver sense antenna
C input impedance (3000pF). The coupler consists of a
C wide-band RF transformer mounted in a foam-filled sealed
C metal chassis. A connector is provided on one side of the
C unit for cable connection to the ADF receiver, and an
C insulated feedthrough is provided on the underside of the
C unit for a jumper wire connection from the sense antenna.

C 10. Radio Digital Distance Magnetic Indicator (RDDMI)

C A. Description and Operation

C The RDDMI (Ref. Fig. 1) is a multiple display indicator with
C integral electronics, monitoring, and warning flags. The
C unit front face consists of a heading dial (compass card),
C two VOR/ADF bearing pointers, two VOR/ADF switches, two VOR
C warning flags, a heading flag, and two DME nautical mileage
C digital counters. Three electrical connectors are provided
C on the rear of the unit for system interface. Internally,
C circuit cards, transformers, synchros, solenoids, and gears
CR are provided to control and drive the indicating components
C and flags. Integral lighting is provided for nighttime
C illumination.

C Power is applied to the Captains RDDMI by closing the 26 VAC
C NAV EXCITATION - RDDMI NO. 1 (K25) and NO. 2 NAV & INSTR -
C CAPT RDDMI (E20) circuit breakers on the pilots overhead
C circuit breaker panel CB1, zone 210. Power is applied to
C the First Officers RDDMI by closing the 26 VAC NAV
C EXCITATION - RDDMI 2 (J20) and NO. 1 NAV & INSTR - FO RDDMI
C (E3) circuit breakers on the CB1. The circuit breakers
C provide 26V ac for bearing synchro excitation and 115V ac
C for the indicator power supplies which provide indicator
C operating voltages.

C (1) Heading Display

C Magnetic heading information is displayed on a rotating
C compass card driven by the applicable compass coupler
C (Ref. 34-22-00). Heading displayed on the Captains

C RDDMI is provided by compass coupler No. 2, and the
C heading displayed on the First Officers RDDMI is
C provided by compass coupler No. 1.

C (2) VOR/ADF Bearing Display

C The VOR/ADF bearing pointer No. 1 (single dash line
CR arrow) displays bearing information provided by VOR No.
CR 1 or ADF No. 1 as selected on the switches provided on
CR the bottom of the RDDMI. The VOR/ADF bearing pointer
CR No. 2 (double line arrow) displays bearing information
CR provided by VOR No. 2 or ADF No. 2. The VOR and ADF
C displays are magnetic bearing to the selected VOR
C station and relative bearing to the selected (tuned)
C ADF station, respectively.

C (3) VOR/ADF Switching

C The switches located on the bottom right and left
C corners of the RDDMI control the selection of the
C information to be displayed on the two pointers
C (pointer No. 1, pointer No. 2). The left switch
C controls pointer No. 1, and the right switch controls
C pointer No. 2. The switches actuate annunciators
CR consisting of VOR and ADF legends and pointer symbols,
CR indicating the mode selected and the pointer displaying
C the selected information.

C (4) DME Display

CR When a VOR ground station frequency (108.00-MHz to
CR 117.95-MHz) is selected on the Captains or First
C Officers VHF NAV control panel, the selected DME
C interrogator (Ref. 34-51-00) transmits interrogation
C pulses to the selected ground station. The ground
C station replies to the DME interrogation signal on an
C associated beacon transmitting frequency. The beacon
C reply signals are applied to the selected DME
CR interrogator, and the interrogator computes elapsed
CR time between interrogation and reply to determine
C distance to the station. The measured distance is then
C displayed on the RDDMI, as either DME-1, or DME-2
C nautical mileage (Ref. Fig. 5).

C (5) Flags

C If no computed distance is applied to the RDDMI from
C the selected DME interrogator, four dashed-lines are
C displayed in the applicable mileage counter (DME-1, or
CR DME-2) on the RDDMI. If either computed data from the
CR selected DME interrogator, or mileage counter circuit
C within the RDDMI is erroneous or malfunctions (as

C determined by the data valid monitor circuit within the
C RDDMI), the applicable mileage counter on the RDDMI is
C covered by a warning flag.

C Flags are also provided to warn of indicator
C malfunctions and loss of magnetic heading reference
CR system (MHRS) or VOR system inputs. A HDG flag appears
CR at top center of the indicator to warn of any of the
C following conditions:

C - Loss of primary power

C - Excessive servo null voltage (indicating an error
C in the displayed heading information)

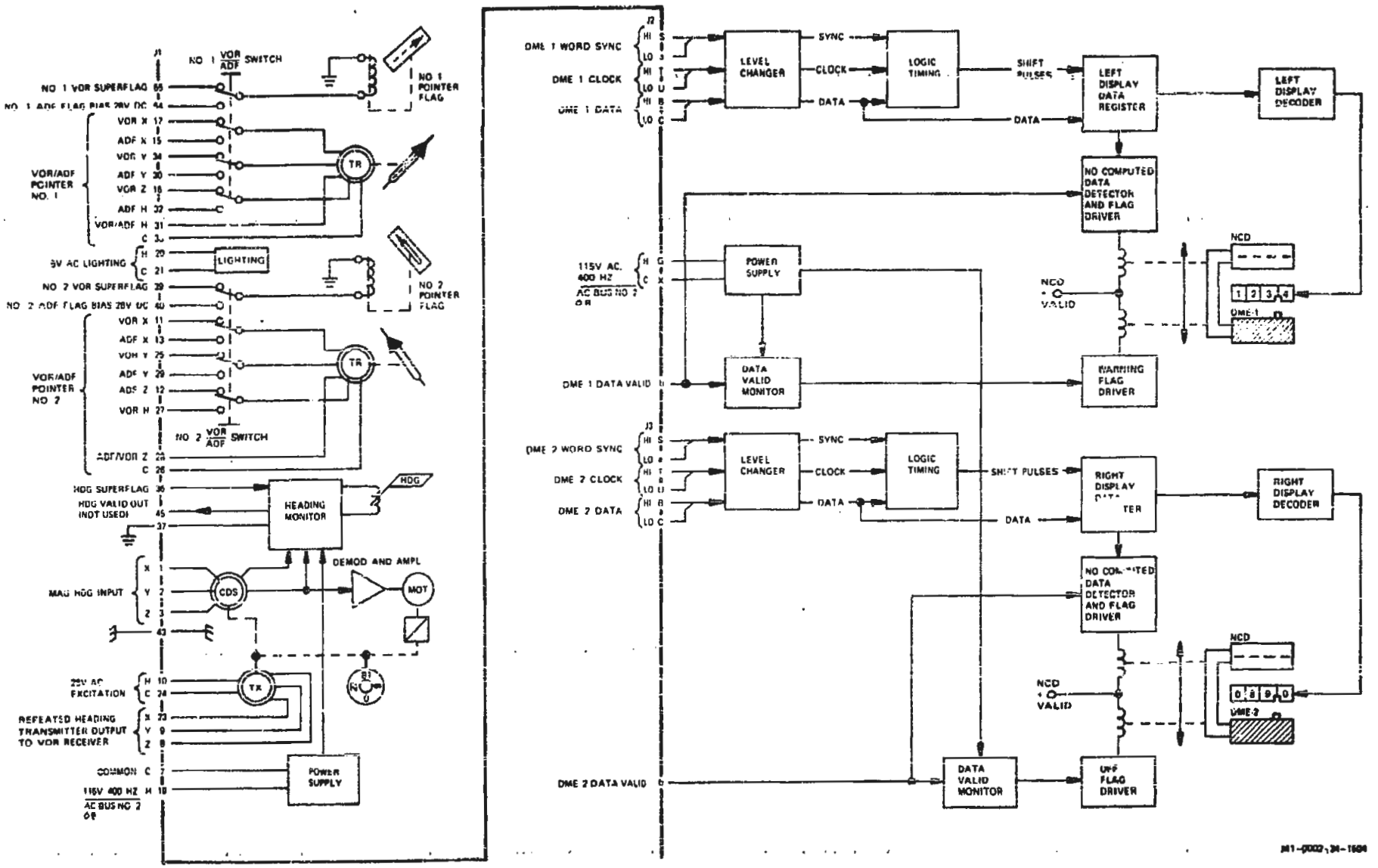
C - Open circuit in control transformer null winding

C - Loss of magnetic heading input

C - Loss of external 28-volts dc data valid signal
C (magnetic heading data valid signal input)

C If the VOR input is selected for either pointer
C display, and the data valid signal from the VOR
C receiver is present, the VOR warning flag (VOR-1, or
C VOR-2) will be out of view. Loss of the data valid
C signal(such as when a localizer frequency is selected
C on the VHF NAV control panel, rather than a VOR
C frequency), causes the applicable VOR warning flag to
C be displayed. When the ADF input is selected for
C display, an externally supplied 28-volts dc signal is
C applied to the associated VOR warning flag solenoid,
C which holds the warning flag out of view.

C No warning flag is provided for ADF operation.



CR Radio Digital Distance Magnetic Indicator Simplified
CR Schematic Diagram
CR Figure 5

EFFECTIVITY: 019, 020, 023-999

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on using fault code diagram or schematic.

If flight crew reports trouble using a FIRM fault code, the code can be found in the 34 Fault Code Index. The index specifies maintenance manual section, fault isolation diagram, and block number on diagram where fault isolation procedure should start. Schematics are included at end of section to supplement fault isolation diagrams or as aid in isolating a problem not covered on diagrams.

Refer to Maintenance Manual Introduction for a more detailed discussion of Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

Since no fault isolation reporting system can cover every failure symptom, system functional schematics are provided giving information for intercomponent signal tracing from source to termination. Supplemental data, in the form of test operational information is provided in Paragraph 4.

R To troubleshoot aircraft wiring, refer to Wiring Manual Diagram Cross Reference (WM DIA CROSS REF) table on system functional schematics listing applicable wiring diagram in L-1011 Wiring Diagram Manual.

2. Supplemental Test Data

RF Signal Generator, Hewlett Packard Model 606, or equivalent with test antenna and connecting coaxial cable.

NOTE: RF signal generator is required only when low frequency homing beacon or radio broadcast station of sufficient strength is not available.

The following applies when performing procedures of Figure 104, Sheets 1 and 2 with rf signal generator:

If rf signal generator is used in lieu of radio broadcasting station or low frequency beacon, BFO/OFF switch must be set BFO position unless rf signal generator used has audio modulation capabilities, or an external source of modulation (audio frequency signal generator) is connected to external modulation jack of rf signal generator.

Position rf signal generator (with test antenna coaxial cable attached to rf output connector) in close proximity to ADF sense antenna No. 1 (ADF sense antenna No. 2). Set rf signal generator and ADF receiver to same frequency. Adjust rf signal generator output attenuator until signal is heard in flight station speakers and ADF pointer on both RDDMI indicate relative bearing to test antenna on rf signal generator. When BFO/OFF switch is set to BFO and an rf carrier is being received, a 1020 Hz tone will be heard in flight station speakers. Although switch is placarded BFO/OFF; the ADF receiver does not contain a beat frequency oscillator. When switch is set to BFO, the
R second IF stage of the ADF receiver is modulated with a 1020 Hz
R signal allowing reception of CW stations.

3. Fault Isolation Identification

Table 101 lists fault isolation diagrams and schematics in this section. Figures 101 and 102 provide ADF system and associated component locations.

Fault Isolation Diagrams and Schematics List
Table 101

	FIG. NO.	TYPE OF TEST
	101	Component Location Index
	102	Component Locator Diagram
	103	BITE Test
R	104	ADF Problems
R R	SCHEM 1 (Sheet 1)	ADF System No. 1 Schematic
R R	SCHEM 1 (Sheet 2)	ADF System No. 2 Schematic
	SCHEM 2	Sense Antenna Lightning Protector Schematic

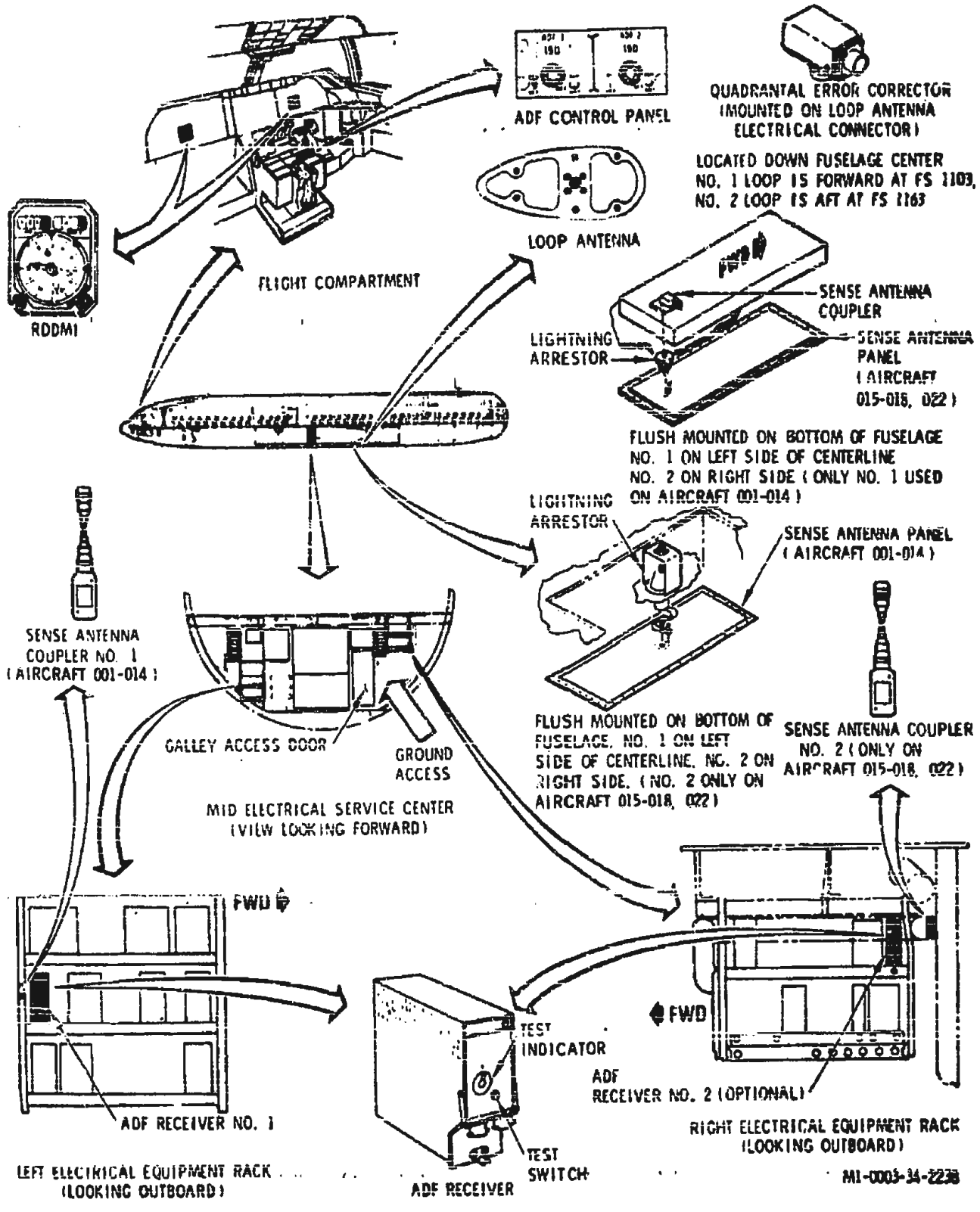
COMPONENT	QTY	ACCESS/AREA	REFERENCE
RECEIVER - ADF	1	MID ELECTRICAL SERVICE CENTER; NO. 1 ON LH EQUIPMENT RACK, SHELF 2	34-57-01
PANEL - ADF CONTROL	1	FLIGHT STATION; PILOTS CENTER CONSOLE	34-57-02
ANTENNA - ADF SENSE	2	LOWER FUSELAGE, WING BUTT AREA	34-57-03
ANTENNA - ADF LOOP	2	LOWER CENTER FUSELAGE JUST AFT OF SENSE ANTENNAS	34-57-04
CORRECTOR - ADF LOOP QUADRANTAL ERROR	2	MOUNTED ON LOOP ANTENNA ELECTRICAL CONNECTOR	34-57-05
INDICATOR - RDDMI	2	CAPTAINS AND FIRST OFFICERS INSTRUMENT PANELS; FLIGHT STATION	34-57-06
COUPLER - ADF SENSE ANTENNA	2	MOUNTED ON SENSE ANTENNA (AIRCRAFT 015-018, 022); OR ON AIRCRAFT 001-014, IN MESC; NO. 1 ON AFT END OF LH EQUIPMENT RACK AND NO. 2 ON AFT BULKHEAD AT AFT END OF RH EQUIPMENT RACK	34-57-09

M1-0001-34-3181

Component Location Index
Figure 101

R EFFECTIVITY: WITH SINGLE ADF
R

001B

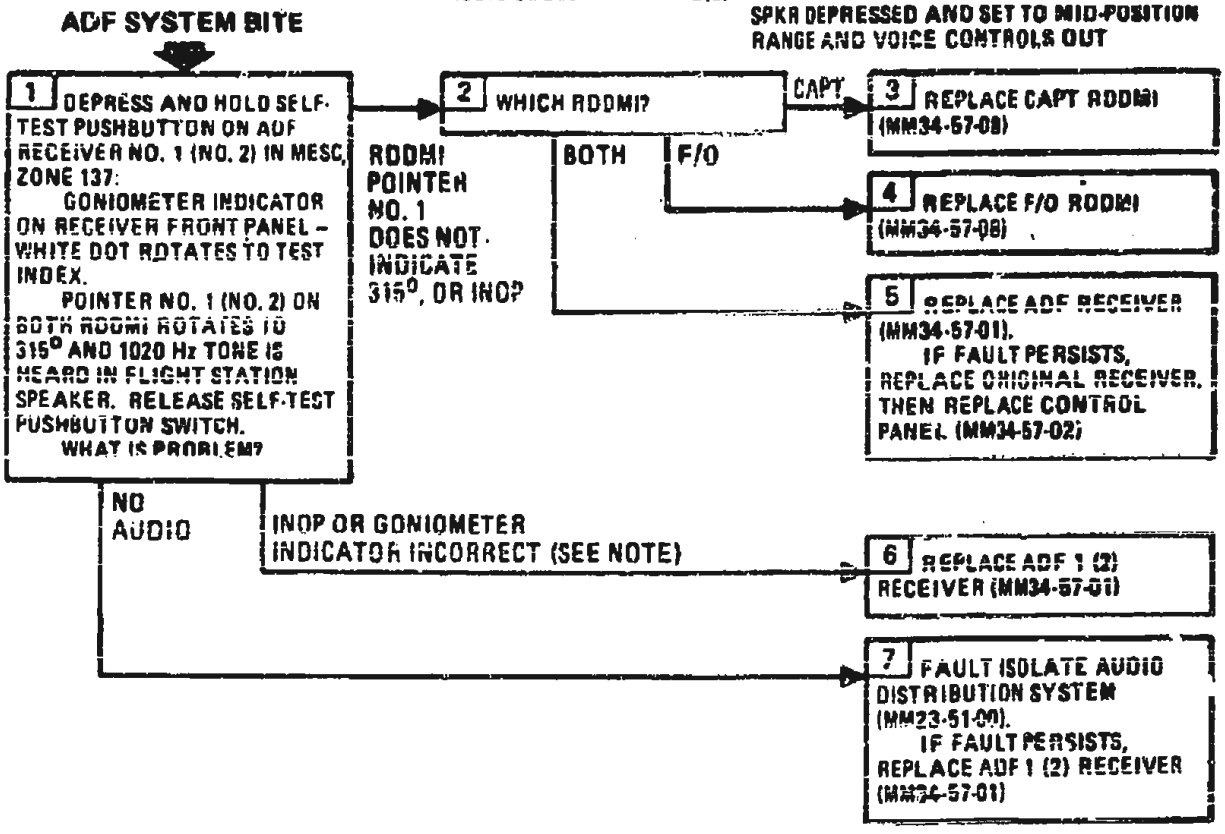

ADF CONTROL PANEL
QUADRANTAL ERROR CORRECTOR (MOUNTED ON LOOP ANTENNA ELECTRICAL CONNECTOR)
LOCATED DOWN FUSELAGE CENTER NO. 1 LOOP IS FORWARD AT FS 1103, NO. 2 LOOP IS AFT AT FS 1163
LOOP ANTENNA
RDDMI
FLIGHT COMPARTMENT
SENSE ANTENNA COUPLER
LIGHTNING ARRESTOR
SENSE ANTENNA PANEL (AIRCRAFT 015-018, 022)
FLUSH MOUNTED ON BOTTOM OF FUSELAGE NO. 1 ON LEFT SIDE OF CENTERLINE NO. 2 ON RIGHT SIDE (ONLY NO. 1 USED ON AIRCRAFT 001-014)
LIGHTNING ARRESTOR
SENSE ANTENNA PANEL (AIRCRAFT 001-014)
SENSE ANTENNA COUPLER NO. 1 (AIRCRAFT 001-014)
GALLEY ACCESS DOOR
GROUND ACCESS
MID ELECTRICAL SERVICE CENTER (VIEW LOOKING FORWARD)
FLUSH MOUNTED ON BOTTOM OF FUSELAGE, NO. 1 ON LEFT SIDE OF CENTERLINE, NO. 2 ON RIGHT SIDE. (NO. 2 ONLY ON AIRCRAFT 015-018, 022)
SENSE ANTENNA COUPLER NO. 2 (ONLY ON AIRCRAFT 015-018, 022)
FWD
FWD
TEST INDICATOR
ADF RECEIVER NO. 2 (OPTIONAL)
ADF RECEIVER NO. 1
TEST SWITCH
ADF RECEIVER
LEFT ELECTRICAL EQUIPMENT RACK (LOOKING OUTBOARD)
RIGHT ELECTRICAL EQUIPMENT RACK (LOOKING OUTBOARD)
M1-0003-34-2238

Component Locator Diagram
Figure 102

R EFFECTIVITY: WITH SINGLE ADF
R

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1D6, 1D9, 1E3, 1E20, 1J20, 1K25, 2A21
ADF CONTROL PANEL: TUNED TO UNUSED FREQUENCY
ADF-OFF-ANT TO ADF
RDDMI BEARING POINTER NO. 1 SWITCH SET TO ADF
AUDIO SELECTOR PANEL(S): ADF 1 DEPRESSED AND SET TO MID-POSITION
SPKR DEPRESSED AND SET TO MID-POSITION
RANGE AND VOICE CONTROLS OUT


ADF SYSTEM BITE
1 DEPRESS AND HOLD SELF-TEST PUSHBUTTON ON ADF RECEIVER NO. 1 (NO. 2) IN MESC, ZONE 137:
GONIOMETER INDICATOR ON RECEIVER FRONT PANEL – WHITE DOT ROTATES TO TEST INDEX.
POINTER NO. 1 (NO. 2) ON BOTH RDDMI ROTATES TO 315° AND 1020 Hz TONE IS HEARD IN FLIGHT STATION SPEAKER. RELEASE SELF-TEST PUSHBUTTON SWITCH.
WHAT IS PROBLEM?
2 WHICH RDDMI?
CAPT
BOTH
F/O
RDDMI POINTER NO. 1 DOES NOT INDICATE 315°, OR INOP
3 REPLACE CAPT RDDMI (MM34-57-08)
4 REPLACE F/O RDDMI (MM34-57-08)
5 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, REPLACE ORIGINAL RECEIVER. THEN REPLACE CONTROL PANEL (MM34-57-02)
NO AUDIO
INOP OR GONIOMETER INDICATOR INCORRECT (SEE NOTE)
6 REPLACE ADF 1 (2) RECEIVER (MM34-57-01)
7 FAULT ISOLATE AUDIO DISTRIBUTION SYSTEM (MM23-51-00).
IF FAULT PERSISTS, REPLACE ADF 1 (2) RECEIVER (MM34-57-01)

NOTE
ADF RECEIVERS WITH A COLLINS – 001 PART NUMBER DO NOT HAVE A LOOP ISOLATION RELAY. THEREFORE, THE LOOP IS STILL CONNECTED DURING SELF TEST. STRAY SIGNAL PICK-UP FROM THE LOOP WILL AFFECT THE GONIOMETER POSITION DURING TEST. THEREFORE, SPECIFIC POSITIONS OF THE GONIOMETER CANNOT BE STATED. IF THE SYSTEM RECEIVES NO SIGNAL DURING TEST, THE GONIOMETER WOULD MOVE CCW TO THE TEST INDEX AND THE RDDMI SINGLE DASHED LINE POINTER WOULD MOVE 45° FROM 270° TO 315°.

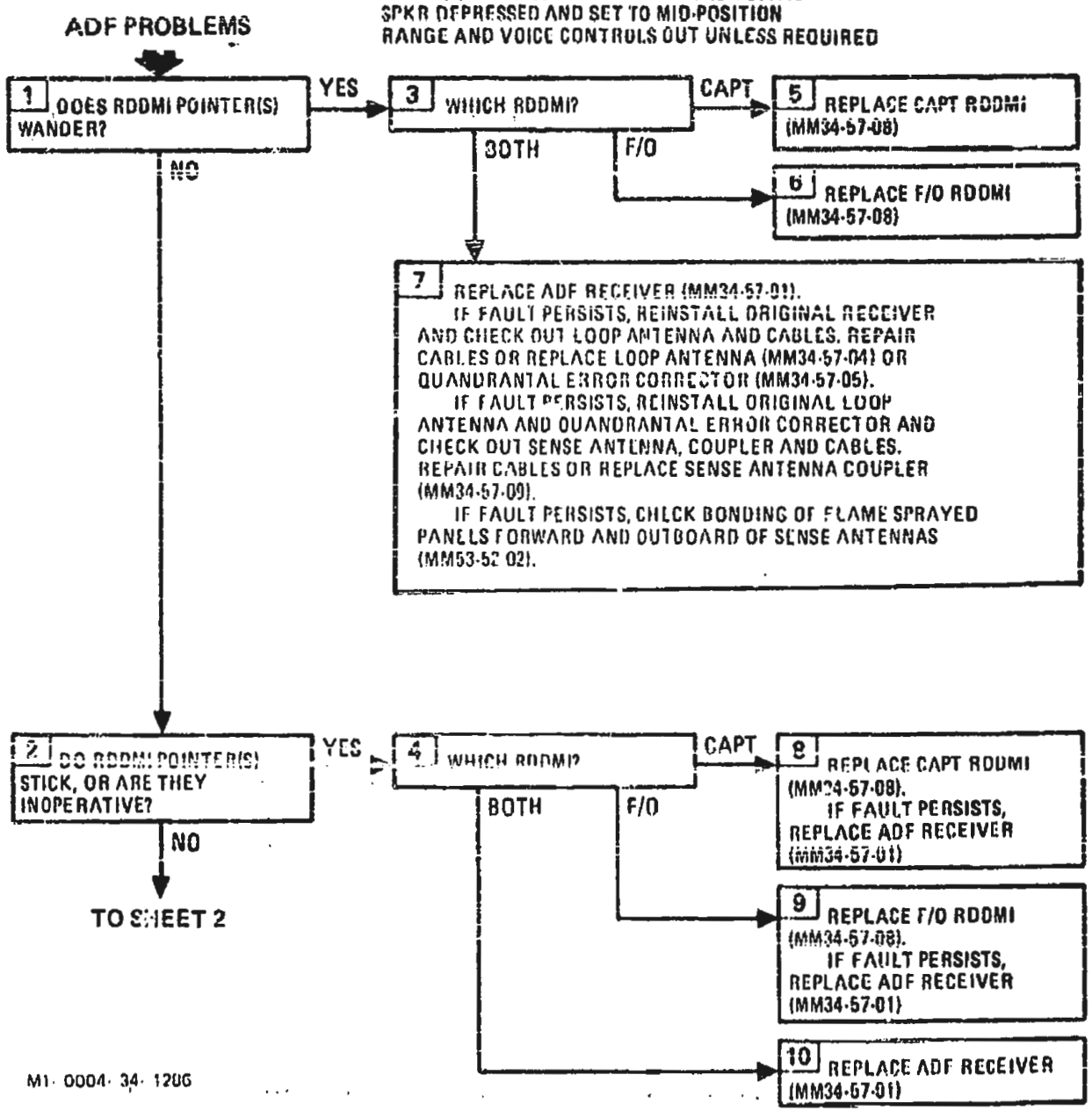
RELEASING THE TEST BUTTON WOULD RETURN THE RDDMI POINTER TO THE 270° STOWED POSITION AND THE GONIOMETER WOULD RETURN TO THE ZERO DEGREE STOWED POSITION. WITH THE PRESENT CONFIGURATION, THE AMOUNT OF MOVEMENT WILL NOT BE EXACT, BUT THE FACT THAT THE POINTER AND GONIOMETER DOT DO MOVE IS SUFFICIENT TO VERIFY THAT THE SYSTEM IS OPERATING NORMALLY.

M1-5004-34-1276

BITE Test
Figure 103

R EFFECTIVITY: WITH SINGLE ADF
R

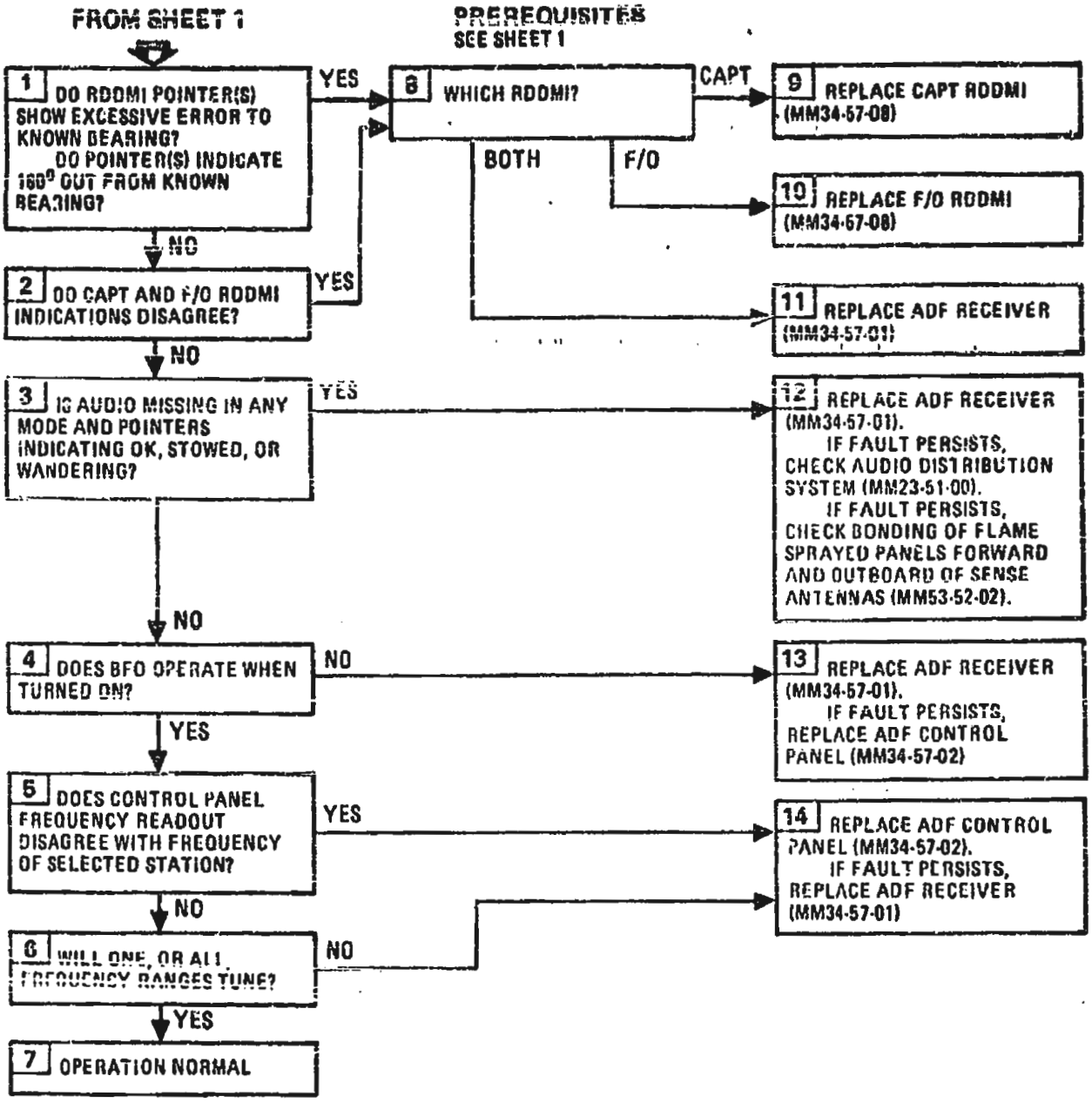
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1D6, 1D9, 1D24, 1D27, 1E3, 1E20, 1J20, 1K25, 2A21
ADF CONTROL PANEL (ADF 1, OR ADF 2)
SET TO FREQUENCY OF LOCAL STATION OR TO SAME FREQUENCY AS SIGNAL GENERATOR
ADF – OFF – ANT SET AS REQUIRED
BFO/OFF TO OFF
RDDMI BEARING POINTER NO. 1 (2) SWITCH SET TO ADF
AUDIO SELECTOR PANEL(S):
ADF 1 (2) DEPRESSED AND SET TO MID-POSITION
SPKR DEPRESSED AND SET TO MID-POSITION
RANGE AND VOICE CONTROLS OUT UNLESS REQUIRED


ADF PROBLEMS
1 DOES RDDMI POINTER(S) WANDER?
YES
3 WHICH RDDMI?
CAPT
5 REPLACE CAPT RDDMI (MM34-57-08)
BOTH
F/O
6 REPLACE F/O RDDMI (MM34-57-08)
NO
7 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, REINSTALL ORIGINAL RECEIVER AND CHECK OUT LOOP ANTENNA AND CABLES. REPAIR CABLES OR REPLACE LOOP ANTENNA (MM34-57-04) OR QUADRANTAL ERROR CORRECTOR (MM34-57-05).
IF FAULT PERSISTS, REINSTALL ORIGINAL LOOP ANTENNA AND QUADRANTAL ERROR CORRECTOR AND CHECK OUT SENSE ANTENNA, COUPLER AND CABLES. REPAIR CABLES OR REPLACE SENSE ANTENNA COUPLER (MM34-57-09).
IF FAULT PERSISTS, CHECK BONDING OF FLAME SPRAYED PANELS FORWARD AND OUTBOARD OF SENSE ANTENNAS (MM53-52-02).
2 DO RDDMI POINTER(S) STICK, OR ARE THEY INOPERATIVE?
YES
4 WHICH RDDMI?
CAPT
8 REPLACE CAPT RDDMI (MM34-57-08).
IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
BOTH
F/O
9 REPLACE F/O RDDMI (MM34-57-08).
IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
NO
TO SHEET 2
10 REPLACE ADF RECEIVER (MM34-57-01)
M1-0004-34-1206

R R ADF Problems
Figure 104 (Sheet 1)

EFFECTIVITY: WITH SINGLE ADF

001B


FROM SHEET 1
PREREQUISITES
SEE SHEET 1
1 DO RDDMI POINTER(S) SHOW EXCESSIVE ERROR TO KNOWN BEARING? DO POINTER(S) INDICATE 180° OUT FROM KNOWN BEARING?
YES
NO
8 WHICH RDDMI?
CAPT
BOTH
F/O
9 REPLACE CAPT RDDMI (MM34-57-08)
10 REPLACE F/O RDDMI (MM34-57-08)
11 REPLACE ADF RECEIVER (MM34-57-01)
2 DO CAPT AND F/O RDDMI INDICATIONS DISAGREE?
YES
NO
3 IS AUDIO MISSING IN ANY MODE AND POINTERS INDICATING OK, STOWED, OR WANDERING?
YES
12 REPLACE ADF RECEIVER (MM34-57-01). IF FAULT PERSISTS, CHECK AUDIO DISTRIBUTION SYSTEM (MM23-51-00). IF FAULT PERSISTS, CHECK BONDING OF FLAME SPRAYED PANELS FORWARD AND OUTBOARD OF SENSE ANTENNAS (MM53-52-02).
NO
4 DOES BFO OPERATE WHEN TURNED ON?
NO
13 REPLACE ADF RECEIVER (MM34-57-01). IF FAULT PERSISTS, REPLACE ADF CONTROL PANEL (MM34-57-02)
YES
5 DOES CONTROL PANEL FREQUENCY READOUT DISAGREE WITH FREQUENCY OF SELECTED STATION?
YES
14 REPLACE ADF CONTROL PANEL (MM34-57-02). IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
NO
6 WILL ONE, OR ALL FREQUENCY RANGES TUNE?
NO
YES
7 OPERATION NORMAL

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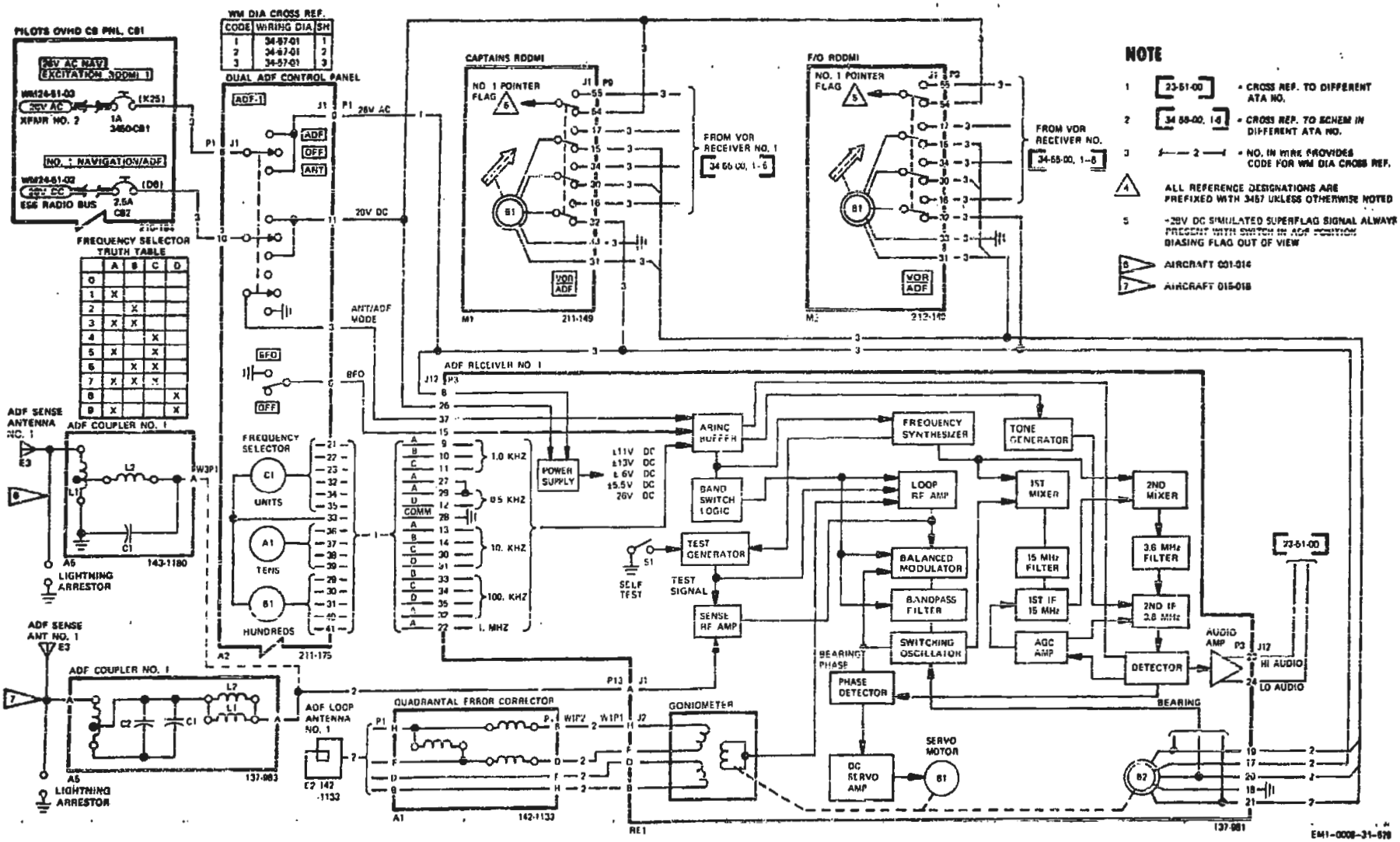
R
R

ADF Problems
Figure 104 (Sheet 2)

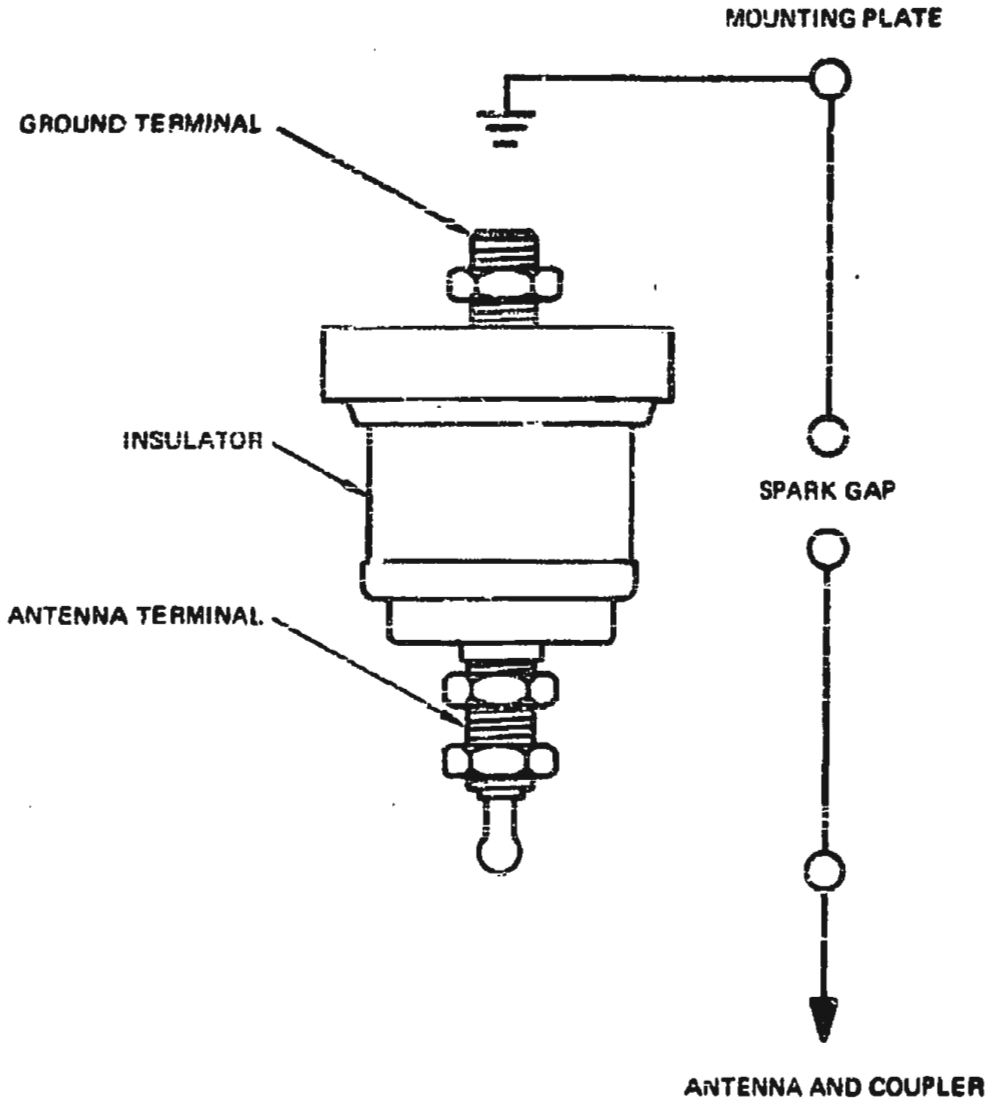
EFFECTIVITY: WITH SINGLE ADF

001B



ADF System Schematic
SCHEM 1

EFFECTIVITY: WITH SINGLE ADF



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Sense Antenna Lightning Protector Schematic
SCHEM 2

C AUTOMATIC DIRECTION FINDER (ADF) SYSTEM - FAULT ISOLATION

C 1. General

C The diagrams and schematics in this section can be used for
C fault isolation any time a fault is reported or suspected. The
CR PREREQUISITES listed at top of each fault isolation diagram must
CR be satisfied prior to starting fault isolation. Uncommon
CR abbreviations are defined on using fault code diagram or
CR schematic.

CR If flight crew reports a trouble using a FIRM fault code, the
CR code can be found in the 34 Fault Code Index. The index
CR specifies maintenance manual section, fault isolation diagram,
CR and block number on diagram where fault isolation procedure
CR should start. Schematics are included at end of section to
CR supplement fault isolation diagrams or as aid in isolating a
CR problem not covered on the diagrams.

CR Refer to Maintenance Manual Introduction for a more detailed
CR discussion of Fault Isolation Reporting Method (FIRM) and use of
C fault isolation diagrams/schematics.

C Since no fault isolation reporting system can cover every
C failure symptom, system functional schematics are provided
C giving information for intercomponent signal tracing from source
C to termination. Supplemental data, in the form of test
C operational information is provided in Paragraph 4.

C To troubleshoot aircraft wiring, refer to Wiring Manual Diagram
CR Cross Reference (WM DIA CROSS REF) table on system functional
CR schematics listing applicable wiring diagram in L-1011 Wiring
C Diagram Manual.

C 2. Supplemental Test Data

C RF Signal Generator, Hewlett Packard Model 606, or equivalent
C with test antenna and connecting coaxial cable.

C NOTE: RF signal generator is only required when low frequency
C homing beacon or radio broadcast station of sufficient
C strength is not available.

C The following apply when performing procedures of Figure 104.

C If rf signal generator is used in lieu of radio broadcasting
C station or low frequency beacon, BFO/OFF switch must be set
C to BFO position unless rf signal generator used has audio
C modulation capabilities, or an external source of modulation
C (audio frequency signal generator) is connected to external
C modulation jack of rf signal generator.

C Position rf signal generator (with test antenna coaxial
C cable attached to rf output connector) in close proximity to
C ADF sense antenna No. 1 (ADF sense antenna No. 2). Set rf
C signal generator and ADF receiver to same frequency. Adjust
C rf signal generator output attenuator until signal is heard
C in flight station speakers and ADF pointer on both RDDMI
C indicate relative bearing to test antenna on rf signal
C generator.

C When BFO/OFF switch is set to BFO and an rf carrier is being
C received, a 1020 Hz tone will be heard in flight station
C speakers. Although switch is placarded BFO/OFF, the ADF
C receiver does not contain a beat frequency oscillator. When
C switch is set to BFO, the second IF stage is modulated with
C a 1020 Hz signal which allows reception of CW stations.

C 3. Fault Isolation Identification

CR Table 101 lists fault isolation diagrams and schematics in this
C section. Figures 101 and 102 provide ADF system and associated
C component locations.

C Fault Isolation Diagrams and Schematics List
C Table 101

FIG. NO.	TYPE OF TEST
101	Component Location Index
102	Component Locator Diagram
103	BITE Test
104	ADF Problems
SCHEM 1	ADF System Schematics
SCHEM 2	Sense Antenna Lightning Protector Schematic

COMPONENT	QTY	ACCESS/AREA	REFERENCE
RECEIVER - ADF	2	MID ELECTRICAL SERVICE CENTER; NO. 1 ON LH EQUIPMENT RACK, SHELF 2; NO. 2 ON RH EQUIPMENT RACK, SHELF 2	34-57-01
PANEL - ADF CONTROL	1	FLIGHT STATION; PILOTS CENTER CONSOLE	34-57-02
ANTENNA - ADF SENSE	2	LOWER FUSELAGE, WING BUTT AREA	34-57-03
ANTENNA - ADF LOOP	2	LOWER CENTER FUSELAGE JUST AFT OF SENSE ANTENNAS	34-57-04
CORRECTOR - ADF LOOP QUADRANTAL ERROR	2	MOUNTED ON LOOP ANTENNA ELECTRICAL CONNECTOR	34-57-05
INDICATOR - RDDMI	2	CAPTAINS AND FIRST OFFICERS INSTRUMENT PANELS; FLIGHT STATION	34-57-06
COUPLER - ADF SENSE ANTENNA	2	MOUNTED ON SENSE ANTENNA	34-57-09

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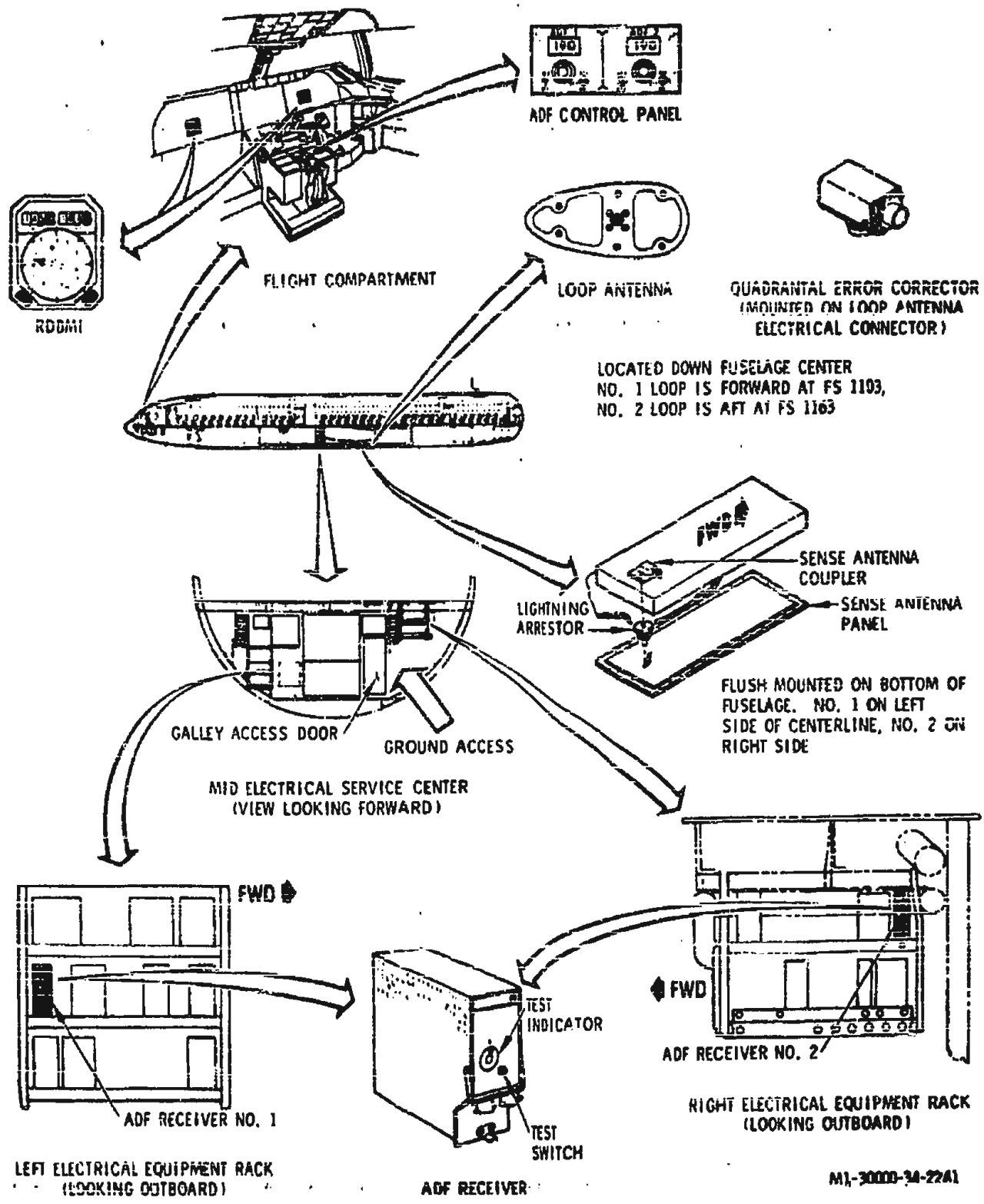
C C Component Location Index
Figure 101

R R EFFECTIVITY: WITH DUAL ADF

002B

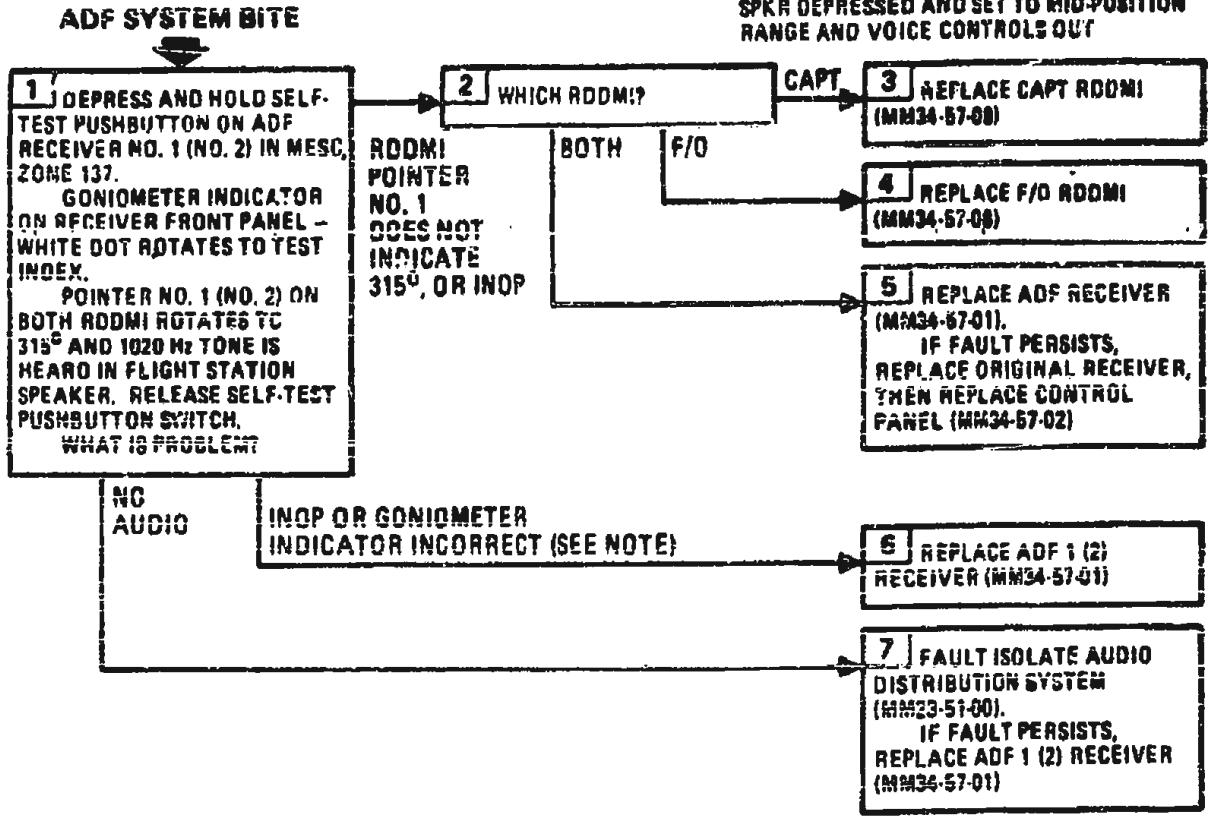

ADF CONTROL PANEL
FLIGHT COMPARTMENT
RDDMI
LOOP ANTENNA
QUADRANTAL ERROR CORRECTOR (MOUNTED ON LOOP ANTENNA ELECTRICAL CONNECTOR)
LOCATED DOWN FUSELAGE CENTER NO. 1 LOOP IS FORWARD AT FS 1103, NO. 2 LOOP IS AFT AT FS 1163
SENSE ANTENNA COUPLER
LIGHTNING ARRESTOR
SENSE ANTENNA PANEL
FLUSH MOUNTED ON BOTTOM OF FUSELAGE. NO. 1 ON LEFT SIDE OF CENTERLINE, NO. 2 ON RIGHT SIDE
GALLEY ACCESS DOOR
GROUND ACCESS
MID ELECTRICAL SERVICE CENTER (VIEW LOOKING FORWARD)
FWD
ADF RECEIVER NO. 1
LEFT ELECTRICAL EQUIPMENT RACK (LOOKING OUTBOARD)
TEST INDICATOR
TEST SWITCH
ADF RECEIVER
FWD
ADF RECEIVER NO. 2
RIGHT ELECTRICAL EQUIPMENT RACK (LOOKING OUTBOARD)
M1-30000-34-2241

C C Component Locator Diagram
Figure 102

R R EFFECTIVITY: WITH DUAL ADF

002B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1D6, 1D9, 1E3, 1E20, 1J20, 1K26, 2A21
ADF CONTROL PANEL: TUNED TO UNUSED FREQUENCY
ADF-OFF-ANT TO ADF
RDDMI BEARING POINTER NO. 1 SWITCH SET TO ADF
AUDIO SELECTOR PANEL(S): ADF 1 DEPRESSED AND SET TO MID-POSITION
SPKR DEPRESSED AND SET TO MID-POSITION
RANGE AND VOICE CONTROLS OUT


ADF SYSTEM BITE
1 DEPRESS AND HOLD SELF-TEST PUSHBUTTON ON ADF RECEIVER NO. 1 (NO. 2) IN MESC, ZONE 137.
GONIOMETER INDICATOR ON RECEIVER FRONT PANEL – WHITE DOT ROTATES TO TEST INDEX.
POINTER NO. 1 (NO. 2) ON BOTH RDDMI ROTATES TO 315° AND 1020 Hz TONE IS HEARD IN FLIGHT STATION SPEAKER. RELEASE SELF-TEST PUSHBUTTON SWITCH.
WHAT IS PROBLEM?
2 WHICH RDDMI?
CAPT
3 REPLACE CAPT RDDMI (MM34-57-08)
RDDMI POINTER NO. 1 DOES NOT INDICATE 315°, OR INOP
BOTH
F/O
4 REPLACE F/O RDDMI (MM34-57-08)
5 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, REPLACE ORIGINAL RECEIVER, THEN REPLACE CONTROL PANEL (MM34-57-02)
NO AUDIO
INOP OR GONIOMETER INDICATOR INCORRECT (SEE NOTE)
6 REPLACE ADF 1 (2) RECEIVER (MM34-57-01)
7 FAULT ISOLATE AUDIO DISTRIBUTION SYSTEM (MM23-51-00).
IF FAULT PERSISTS, REPLACE ADF 1 (2) RECEIVER (MM34-57-01)

NOTE
ADF RECEIVERS WITH A COLLINS – 001 PART NUMBER DO NOT HAVE A LOOP ISOLATION RELAY. THEREFORE, THE LOOP IS STILL CONNECTED DURING SELF TEST. STRAY SIGNAL PICK-UP FROM THE LOOP WILL AFFECT THE GONIOMETER POSITION DURING TEST. THEREFORE, SPECIFIC POSITIONS OF THE GONIOMETER CANNOT BE STATED. IF THE SYSTEM RECEIVES NO SIGNAL DURING TEST, THE GONIOMETER WOULD MOVE CCW TO THE TEST INDEX AND THE RDDMI SINGLE DASHED LINE POINTER WOULD MOVE 45° FROM 270° TO 315°.

RELEASING THE TEST BUTTON WOULD RETURN THE RDDMI POINTER TO THE 270° STOWED POSITION AND THE GONIOMETER WOULD RETURN TO THE ZERO DEGREE STOWED POSITION. WITH THE PRESENT CONFIGURATION, THE AMOUNT OF MOVEMENT WILL NOT BE EXACT, BUT THE FACT THAT THE POINTER AND GONIOMETER DOT DO MOVE IS SUFFICIENT TO VERIFY THAT THE SYSTEM IS OPERATING NORMALLY

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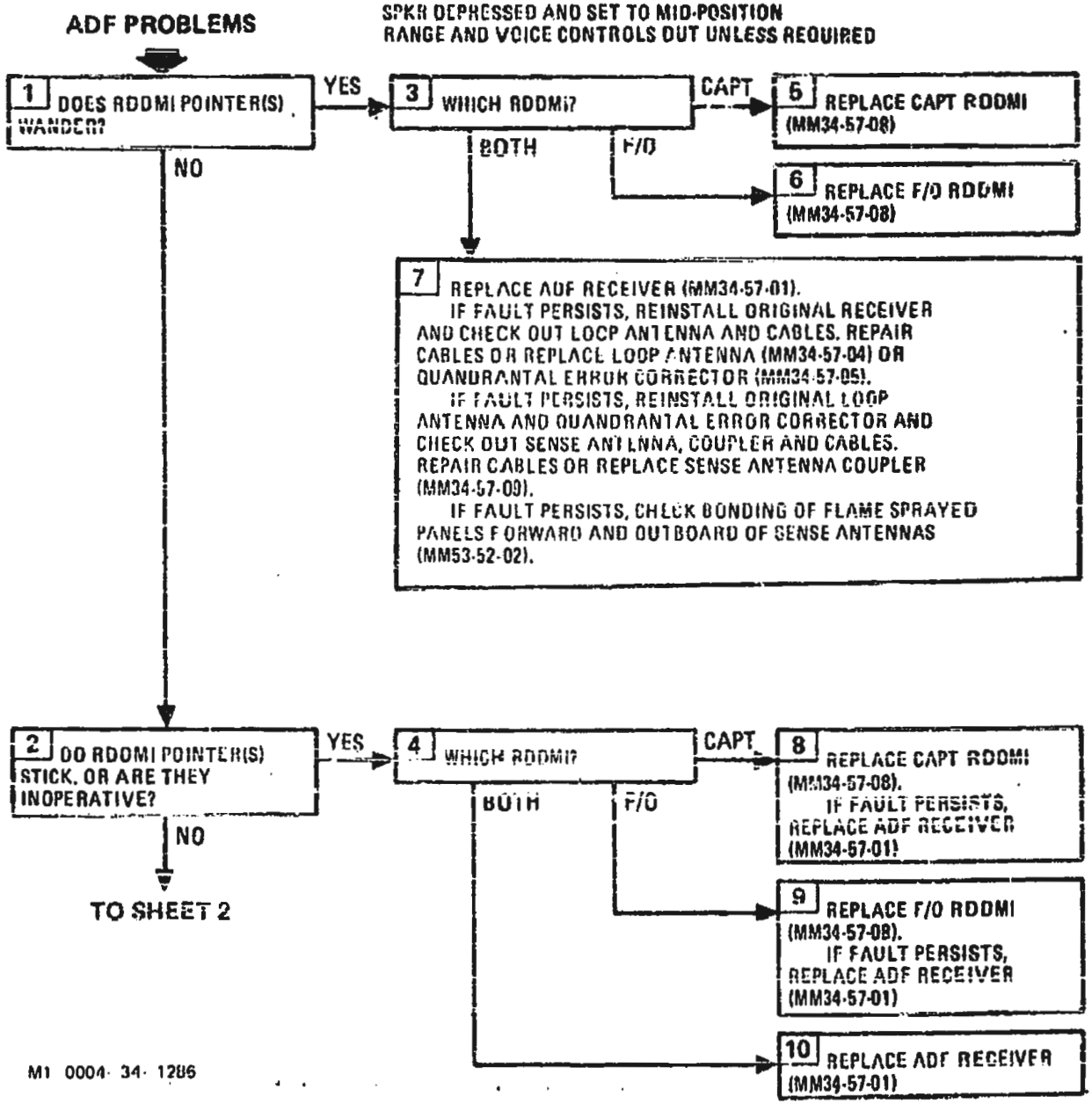
CR
CR

BITE Test
Figure 103

EFFECTIVITY: WITH DUAL ADF

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 106, 1D9, 1D24, 1D27, 1E3, 1E20, 1J20, 1K20, 2A21
ADF CONTROL PANEL (ADF 1, OR ADF 2)
SET TO FREQUENCY OF LOCAL STATION OR TO SAME FREQUENCY AS SIGNAL GENERATOR
ADF -- OFF -- ANT SET AS REQUIRED
BFO/OFF TO OFF
RDDMI BEARING POINTER NO. 1 (2) SWITCH SET TO ADF
AUDIO SELECTOR PANEL(S):
ADF 1 (2) DEPRESSED AND SET TO MID-POSITION
SPKR DEPRESSED AND SET TO MID-POSITION
RANGE AND VOICE CONTROLS OUT UNLESS REQUIRED

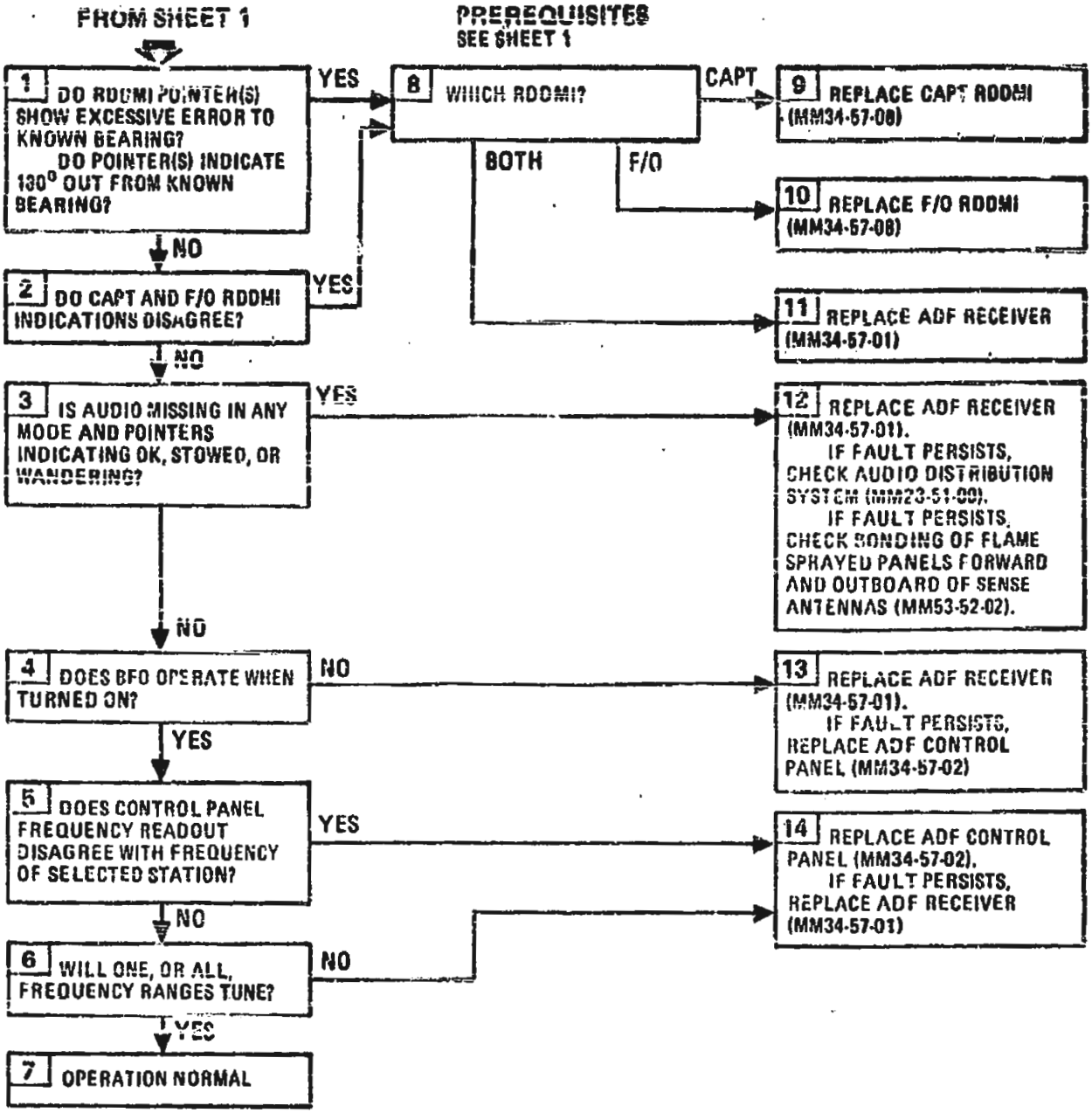

ADF PROBLEMS
1 DOES RDDMI POINTER(S) WANDER?
YES
3 WHICH RDDMI?
CAPT
5 REPLACE CAPT RDDMI (MM34-57-08)
BOTH
F/O
6 REPLACE F/O RDDMI (MM34-57-08)
NO
7 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, REINSTALL ORIGINAL RECEIVER AND CHECK OUT LOOP ANTENNA AND CABLES. REPAIR CABLES OR REPLACE LOOP ANTENNA (MM34-57-04) OR QUANDRANTAL ERROR CORRECTOR (MM34-57-05).
IF FAULT PERSISTS, REINSTALL ORIGINAL LOOP ANTENNA AND QUANDRANTAL ERROR CORRECTOR AND CHECK OUT SENSE ANTENNA, COUPLER AND CABLES. REPAIR CABLES OR REPLACE SENSE ANTENNA COUPLER (MM34-57-09).
IF FAULT PERSISTS, CHECK BONDING OF FLAME SPRAYED PANELS FORWARD AND OUTBOARD OF SENSE ANTENNAS (MM53-52-02).
2 DO RDDMI POINTER(S) STICK, OR ARE THEY INOPERATIVE?
YES
4 WHICH RDDMI?
CAPT
8 REPLACE CAPT RDDMI (MM34-57-08).
IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
BOTH
F/O
9 REPLACE F/O RDDMI (MM34-57-08).
IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
NO
TO SHEET 2
10 REPLACE ADF RECEIVER (MM34-57-01)
M1 0004 34 1286

CR
CR

ADF Problems
Figure 104 (Sheet 1)

EFFECTIVITY: WITH DUAL ADF

002B


FROM SHEET 1
PREREQUISITES
SEE SHEET 1
1 DO RDDMI POINTER(S) SHOW EXCESSIVE ERROR TO KNOWN BEARING?
DO POINTER(S) INDICATE 180° OUT FROM KNOWN BEARING?
YES
NO
8 WHICH RDDMI?
CAPT
BOTH
F/O
9 REPLACE CAPT RDDMI (MM34-57-08)
10 REPLACE F/O RDDMI (MM34-57-08)
2 DO CAPT AND F/O RDDMI INDICATIONS DISAGREE?
YES
NO
11 REPLACE ADF RECEIVER (MM34-57-01)
3 IS AUDIO MISSING IN ANY MODE AND POINTERS INDICATING OK, STOWED, OR WANDERING?
YES
NO
12 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, CHECK AUDIO DISTRIBUTION SYSTEM (MM23-51-00).
IF FAULT PERSISTS, CHECK BONDING OF FLAME SPRAYED PANELS FORWARD AND OUTBOARD OF SENSE ANTENNAS (MM53-52-02).
4 DOES BFO OPERATE WHEN TURNED ON?
NO
YES
13 REPLACE ADF RECEIVER (MM34-57-01).
IF FAULT PERSISTS, REPLACE ADF CONTROL PANEL (MM34-57-02)
5 DOES CONTROL PANEL FREQUENCY READOUT DISAGREE WITH FREQUENCY OF SELECTED STATION?
YES
NO
14 REPLACE ADF CONTROL PANEL (MM34-57-02).
IF FAULT PERSISTS, REPLACE ADF RECEIVER (MM34-57-01)
6 WILL ONE, OR ALL, FREQUENCY RANGES TUNE?
NO
YES
7 OPERATION NORMAL

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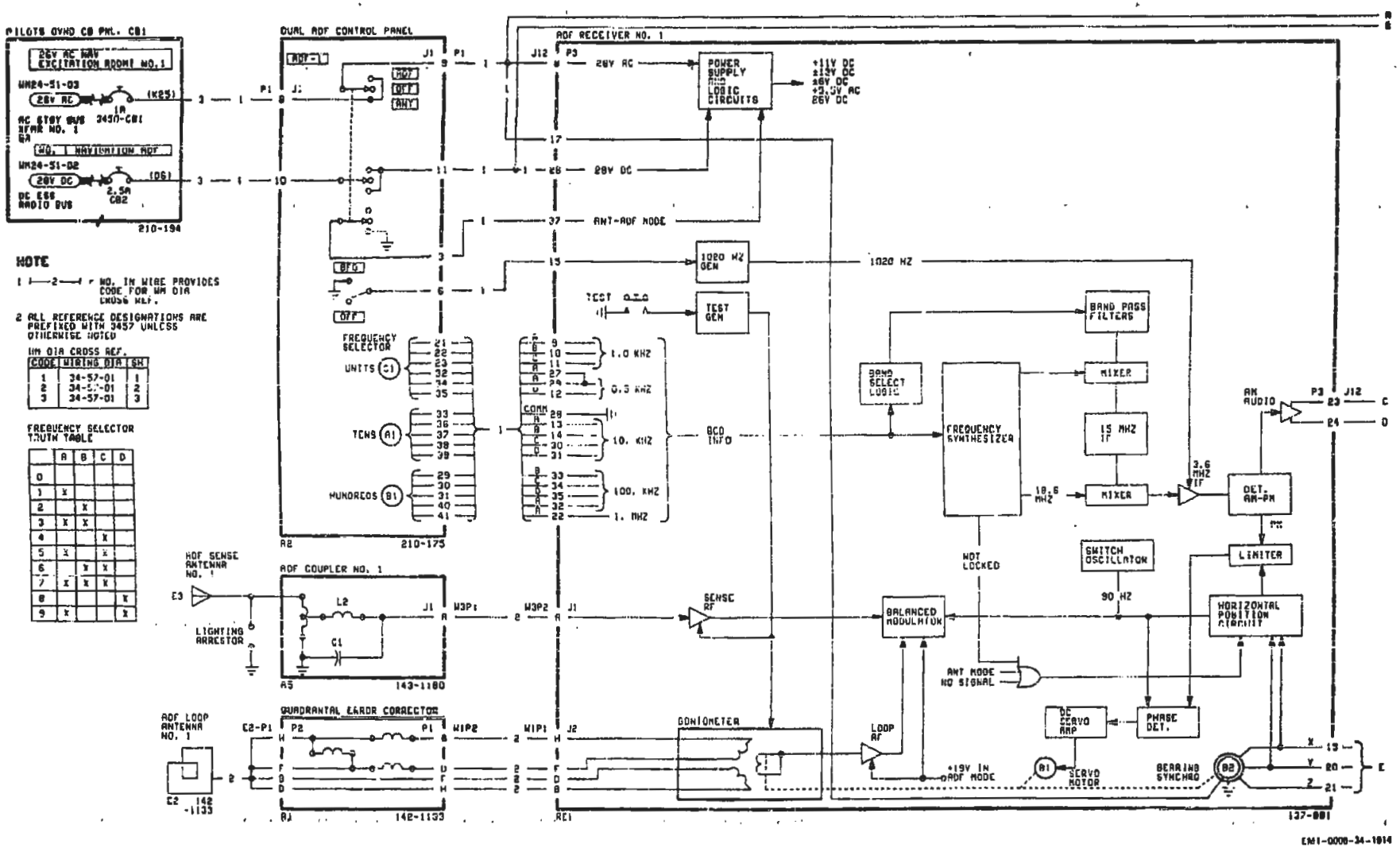
CR
CR

ADF Problems
Figure 104 (Sheet 2)

EFFECTIVITY: WITH DUAL ADF

0028



NOTE

1 —2— NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

2 ALL REFERENCE DESIGNATIONS ARE PREFIXED WITH 3457 UNLESS OTHERWISE NOTED

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	34-57-01	1
2	34-57-01	2
3	34-57-01	3

FREQUENCY SELECTOR TRUTH TABLE

	A	B	C	D
0				
1	X			
2		X		
3	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X

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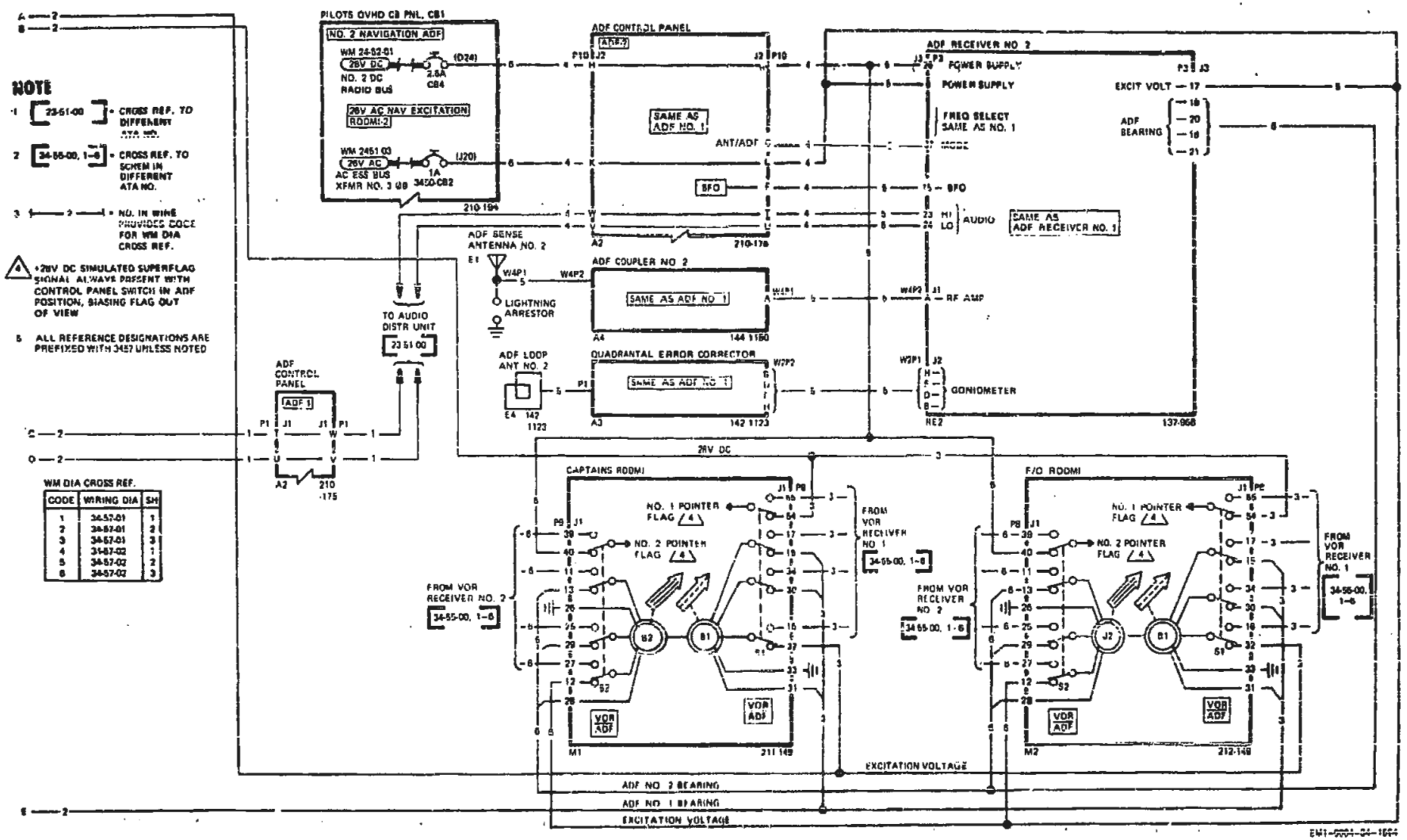
CR
CR

ADF System Schematic
SCHEM 1 (Sheet 1)

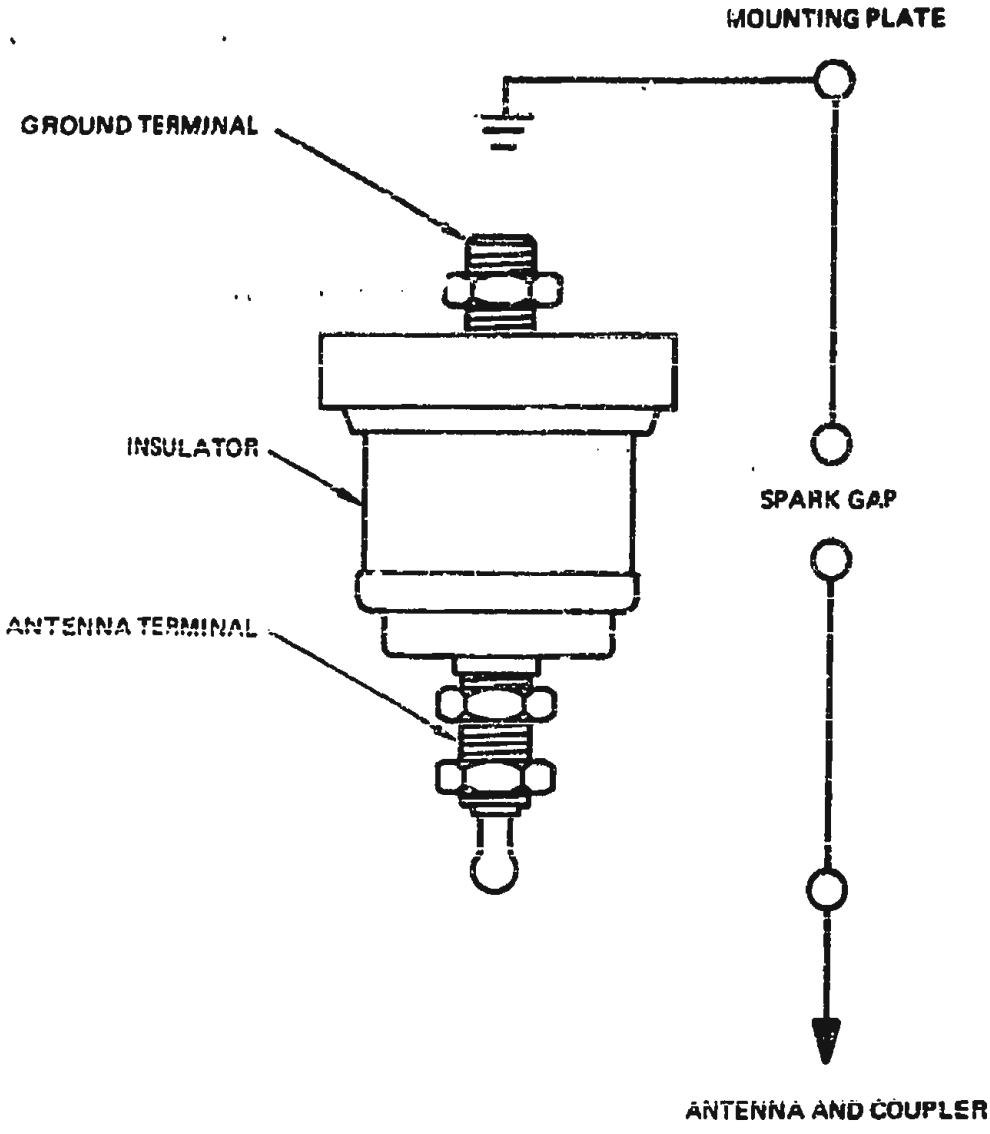
EFFECTIVITY: WITH DUAL ADF

0028



CR ADF System Schematic
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: WITH DUAL ADF



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Sense Antenna Lightning Protector Schematic
SCHEM 2

R EFFECTIVITY: WITH DUAL ADF
R

0028

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

RF Signal Generator, Hewlett Packard Model 606, or equivalent with test antenna and connecting coaxial cable

NOTE: RF signal generator is only required when low frequency homing beacon and radio broadcast station of sufficient strength are not available.

2. Referenced Procedures

24-00-00 Electrical Power System - Maintenance Practices

34-22-00 Magnetic Heading Reference System - Adjustment and Test

3. Adjustment/Test

A. Preparation

(1) On pilots overhead circuit breaker panel CB1; ensure the following circuit breakers are engaged:

ADF (D6)

INSTR XFMR NO. 2 (D9)

INSTR XFMR NO. 3 (D27)

F/O RDDMI (E3)

CAPT RDDMI (E20)

INSTR XFMR NO. 1 (F5)

DIR GYRO (G5)

CMPS CPLR (G7)

DIR GYRO (G23)

CMPS CPLR (G26)

CMPS CPLR -2 (J19)

RDDMI 2 (J20)

CMPS CPLR-1 (K19)

CMPS CPLR-2 (K24)

RDDMI NO. 1

AUDIO CONTROL - CAPT & F/E (A12)

AUDIO CONTROL - F/O & OBS (A13)

FLT INTPH AMPL (A14)

(2) Turn on aircraft electrical power (Ref. 24-00-00).

(3) On FE/SO ECS Monitor Panel, ensure AVIONIC AIR - FWD and MID LO FLO lights are out.

NOTE: If only operational test is to be performed, proceed to Step A(5).

(4) Energize audio integrating system (Ref. 23-51-00).

Depress ADF-1 control on both Captains and First Officers audio selector panels and set to mid position.

Depress SPKR control on both Captains and First Officers audio selector panels and set to mid position.

NOTE: Do not depress and set RANGE and/or VOICE (filter) controls on either audio selector panel unless required to clarify reception.

(5) Set VOR/ADF switches (single dash line arrow) on both RDDMI to ADF.

(6) On ADF control panel located in pilots center console in flight station, zone 210; set ADF-1, ADF-OFF-ANT switch to ADF.

(7) Establish communications between flight station and mid electrical service center (operational test) or between flight station and technician at rf signal generator (functional test), (Ref. 23-43-00).

NOTE: Allow 10 minutes warmup before proceeding.

B. Operational Test

NOTE: Ensure receiver is not tuned to an operating station.

Reliable self-test bearing indications are sometimes difficult to obtain in certain areas due to the presence of nearby noise sources or to overcrowding of the broadcast band at night.

(1) On both Capt and F/O compass controllers, set both MHRS No. 1 and No. 2 to DG mode and slew both systems to 0 degree heading. Verify on Capt and F/O HSI and RDDMI compass cards.

(2) In mid electrical service center, zone 137; depress and hold self test pushbutton switch on ADF receiver front panel:

On goniometer indicator located on ADF receiver front panel; orientation mark (white dot) goes to 45-degrees and single dash line pointer on both RDDMI go to 315-degrees and 1020-Hz tone is heard in both flight station speakers.

(3) Release self test pushbutton switch:

Orientation mark on goniometer indicator goes to 90-degrees, single dash line pointer on both RDDMI go to 270-degrees, and 1020-Hz tone is silenced.

NOTE: The present configuration of the ADF installation DOES NOT have a loop isolation relay. Therefore, the loop is still connected during self test. Stray signal pick-up from the loop will affect the goniometer position during test. Therefore, specific positions of the goniometer cannot be stated. If the system receives no signal during test, the gonimeter would move CCW to the test index and the RDDMI single dashed line pointer would move 45-degrees from 270-degrees tp 315-degrees.

Releasing the test button would return the RDDMI pointer to the 270-degree stowed position, and the goniometer would return to the zero degree stowed position. With the present configuration, the amount of movement will not be exact, but the fact that the pointer and goniometer dot DO MOVE is sufficient to verify that the system is operating normally.

(4) If functional test is not to be performed; perform shutdown procedure as outlined in Paragraph D.

C. Functional Test

(1) On ADF control panel; set ADF-1, BFO/OFF switch to OFF.

NOTE: If rf signal generator is used in lieu of radio broadcasting station and low frequency beacon, BFO/OFF switch must be set to BFO position unless rf signal generator used has audio modulation capabilities, or an external source of modulation (audio frequency signal generator) is connected to external modulation jack on rf signal generator.

Position rf signal generator (with test antenna coaxial cable attached to rf output connector) in close proximity to ADF sense antenna No. 1 (FS 1043, LBL42.5). Set rf signal generator and ADF receiver to same frequency. Adjust rf signal generator output attenuator until signal is heard in flight station speakers and single dash line pointer on both RDDMI indicate relative bearing to test antenna on rf signal generator.

When BFO/OFF switch is set to BFO and an rf carrier is being received, a 1020 Hz tone will be heard in flight station speakers.

(2) On ADF control panel; set ADF-1 frequency selector to local radio broadcast station (190-1750 kHz).

Signal dash line pointers on both RDDMI indicate bearing to received station and station audio is heard in flight station speakers.

NOTE: Flight line conduit, metal buildings etc., distort strong local signals, so the received bearing data displayed on the RDDMI will be inaccurate. When a sky wave signal is received, erratic unpredictable bearing data is normal. A ground wave only signal supplies a stable, but not necessarily accurate bearing signal and a sky wave signal supplies erratic bearing data. These conditions are to be expected during ground operation of the system only.

If greater test accuracy is desired; the rf signal generator must be used.

(3) On ADF control panel; set ADF-1, BFO/OFF switch to BFO.

A 1020-Hz tone is heard in flight station speakers and single dash line pointers on RDDMI indicate relative bearing to received station. If station audio is present [Step C(2)], 1020-Hz tone signal will be heard along with station audio in flight station speakers.

NOTE: Although switch is placarded ADF-1, BFO/OFF; the 51Y-7 ADF receiver does not contain a beat frequency oscillator. When switch is set to BFO, the second IF stage is modulated with a 1020-Hz signal. The normal BFO chirp sound is replaced with a constant 1020-Hz tone when a carrier is being received, allowing reception of CW only stations.

(4) On ADF control panel; set ADF-1, BFO/OFF switch to OFF.

1020-Hz tone signal is silenced.

(5) On ADF control panel; set ADF-1, ADF-OFF-ANT switch to ANT.

Single dash line pointers on RDDMI stow to horizontal position and station audio is heard in flight station speakers.

(6) On ADF control panel; set ADF-1, BFO/OFF switch to BFO.

A 1020-Hz tone signal is heard in flight station speakers. If station audio is present, 1020-Hz tone signal will be heard along with station audio in flight station speakers.

(7) On ADF control panel; set ADF-1, BFO/OFF switch to OFF.

1020-Hz tone signal is silenced.

(8) On ADF control panel; set ADF-1, ADF-OFF-ANT switch to ADF.

Single dash line pointers on RDDMI unstow and indicate relative bearing to received station and station audio is heard in flight station speakers.

D. Shutdown

(1) On ADF control panel; set ADF-1, ADF-OFF-ANT switch to OFF.

(2) Shut down audio integrating system (Ref. 23-51-00).

Pull out ADF-1 control on both Captains and First Officers audio selector panels.

Pull out SPKR control on both Captains and First Officers audio selector panels.

NOTE: If RANGE and/or VOICE controls were used, pull out.

(3) Shut down aircraft electrical power (Ref. 24-00-00).

C AUTOMATIC DIRECTION FINDER (ADF) SYSTEM - ADJUSTMENT AND TEST

C 1. Equipment and Materials

C RF Signal Generator, Hewlett Packard Model 606, or equivalent
C with test antenna and connecting coaxial cable

C NOTE: RF signal generator is required only when low
C frequency homing beacon and radio broadcast station
C of sufficient strength is not available.

C 2. Referenced Procedures

C 24-00-00 Electrical Power System - Maintenance Practices

C 34-22-00 Magnetic Heading Reference System - Adjustment and
C Test

C 34-43-00 Inertial Navigation System - Adjustment and Test
C (Aircraft with INERTIALS)

C 3. Adjustment/Test

C A. Preparation

C (1) On pilots overhead circuit breaker panel CB1; ensure
C following circuit breakers are engaged:

C ADF (D6)

C ADF (D24)

C INSTR XFMR NO. 2 (D9)

C INSTR XFMR NO. 3 (D27)

C F/O RDDMI (E3)

C CAPT RDDMI (E20)

C INSTR XFMR NO. 1 (F5)

C INS HTR (E7)

C INS PWR (E6) (IF INERTIALS INSTALLED)

C DIR GYRO (G5) (IF INERTIALS NOT INSTALLED)

C VG/INS-1 (G6)

C CMPS COUPLER (G7)

C DIR GYRO (G23) (IF INERTIALS NOT INSTALLED)

C INS/VERT GYRO (G24) (IF INERTIALS INSTALLED)

C INS HTR (G25) (IF INERTIALS INSTALLED)

C CMPS CPLR (G26)

C CMPS CPLR-2 (J19)

C RDDMI 2 (J20)

C CMPS CPLR-1 (K19)

C CMPS CPLR-1 (K24)

C RDDMI 1 (K25)

C AUDIO CONTROL - CAPT & F/E (A12)

C AUDIO CONTROL - F/O & OBS (A13)

C FLT INTPH AMPL (A14)

C (2) Turn aircraft electrical power ON (Ref. 24-00-00).

C (3) On FE/SO ECS MONITOR panel, ensure AVIONIC AIR-FWD,
CR MID, and INS COOLING LO FLO lights are off.

C NOTE: If only operational test is to be performed,
C proceed to Step A(8).

C (4) If aircraft is equipped with INERTIAL system, energize
C inertial systems and set to attitude reference mode
C (Ref. 34-43-00).

C (5) Verify magnetic heading reference system is operative
C (Ref. 34-22-00); and if aircraft is equipped with
C INERTIAL system, verify RAD/NAV switchlights are set to
C RAD.

C (6) On Captains and First Officers compass controllers;
C press MAG pushbutton switch and wait four minutes.

C Needles on both compass controllers are centered

C HDG flags out of view on both RDDMI

C Both RDDMI compass cards indicate same aircraft
C heading

C NOTE: If circuit breakers CAPT HSI (F3) and F/O HSI
C (F21) on pilots overhead circuit breaker panel
C CB1 are engaged; both HDG flags will be out of
C view and compass cards will indicate same
C aircraft heading and be in agreement with RDDMI
C compass cards.

C (7) Energize audio integrating system as follows:

C NOTE: The following steps test ADF System No. 1 and/or
C No. 2. System No. 2 equipment is indicated by
C parentheses.

C (a) On Captains and First Officers audio selector
C panels, press ADF1 (ADF2) control and set to mid
C position.

C (b) On Captains and First Officers audio selector
C panels, press SPKR control and set to mid
C position.

C NOTE: Do not press and set RANGE and/or VOICE
C (filter) controls on either audio selector
C panel unless required to clarify reception.

C (8) Set VOR/ADF switches on both RDDMIs to ADF.

C (9) On ADF control panel located in pilots center console
C in flight station, zone 210;

C (10) Establish communications as follows:

C (a) On MIC SELECTION panel under FE/SO table, connect
C service interphone handset to SERVICE INTERPHONE
C jack, and press SERVICE INTERPHONE - ON
C switchlight on.

C (b) For Operational Test (Para. B), connect service
C interphone handset to mid electrical service
C center service interphone jack located on galley
C door frame half-way up outboard edge near service
C light switch, zone 137.

C (c) If performing Functional Test (Para. C) using rf
C signal generator, connect service interphone
C handset to service interphone jack located on left
C or right main landing gear door ground release
C service panel, zone 143 or 144.

C NOTE: Allow 10-minutes warmup before proceeding.

C B. Operational Test

C NOTE: Ensure receiver to be tested is not tuned to an
C operating station.

C (1) In mid electrical service center, zone 137; press and
C hold self test pushbutton switch on ADF receiver No. 1
C (No. 2) front panel.

C On goniometer indicator located on ADF receiver
C front panel; orientation mark (white dot) moves to
C TEST position (45-degrees), ADF pointer on both
C RDDMIs indicate 315-degrees and 1020-Hz tone is
C heard in both flight station speakers.

C (2) Release self test pushbutton switch.

C Orientation mark on goniometer indicator indicates
C 0-degrees, ADF pointer on both RDDMIs stow
C horizontally, and 1020-Hz tone is silenced.

C (3) If functional test is not to be performed; perform
C shutdown procedure as outlined in Paragraph D.

C C. Functional Test

C (1) On ADF control panel; set ADF-1 (ADF-2) BFO/OFF switch
C to OFF.

C NOTE: If rf signal generator is used in lieu of radio
C broadcasting station and low frequency beacon,
C BFO/OFF switch must be set to BFO position
C unless rf signal generator used has audio
C modulation capabilities, or an external source
C of modulation (audio frequency signal generator)
C is connected to external modulation jack on rf
C signal generator.

C Position rf signal generator (with test antenna
C coaxial cable attached to rf output connector)
C in close proximity to ADF sense antenna No. 1
C (FS 1043, LBL 42.5) [ADF sense antenna No. 2 (FS
C 1043, RBL 42.5)]. Set rf signal generator and
C ADF receiver to same frequency. Adjust rf
C signal generator output attenuator until signal
C is heard in flight station speakers and ADF
C pointer on both RDDMIs indicate relative bearing
C to test antenna on rf signal generator.

C When BFO/OFF switch is set to BFO and an rf

C carrier is being received, a 1020-Hz tone will
C be heard in flight station speakers.

C (2) On ADF control panel; set ADF-1 (ADF-2) frequency
C selector to known local radio broadcast station
C (190-1750 KHz).

CR ADF pointers on both RDDMIs indicate a bearing when
CR tuned to known station and station audio is heard in
CR flight station speakers. Do not attempt to evaluate
CR actual bearing indication.

CR NOTE: Flight line conduit, metal buildings, poles,
CR etc. have the ability to distort the wave fronts
CR of even strong local signals, so R. F. bearing
CR data is not reliable in test environment. When
CR sky wave is received, erratic unpredictable
CR bearing data is normal and must be expected.
CR Generally, a ground wave only signal will yield
CR a stable but not necessarily accurate bearing
CR whereas sky wave bearings will be erratic.

C (3) On ADF control panel; set ADF-1 (ADF-2) BFO/OFF switch
C to BFO.

C A 1020-Hz tone is heard in flight station
C speakers. If station audio is present [Step (2)],
C 1020-Hz tone signal will be heard along with
C station audio in flight station speakers.

C NOTE: Although switch is placarded BFO/OFF, the 51Y-7
C ADF receiver does not contain a beat frequency
C oscillator. When switch is set to BFO, the
C second IF stage is modulated with a 1020-Hz
C signal. The normal BFO chirp sound is replaced
C with a constant 1020-Hz tone when a carrier is
C being received, allowing reception of CW only
C stations.

C (4) On ADF control panel; set ADF-1 (ADF-2) BFO/OFF switch
C to OFF.

C 1020-Hz tone signal is silenced.

C (5) On ADF control panel; set ADF-1 (ADF-2) ADF-OFF ANT
C switch to ANT.

C ADF pointers on RDDMIs stow to horizontal position
C and station audio is heard in flight station
C speakers.

C (6) On ADF control panel; set ADF-1 (ADF-2) BFO/OFF switch
C to BFO.

C A 1020-Hz tone signal is heard in flight station
C speakers. If station audio is present, 1020-Hz
C tone signal will be heard along with station audio
C in flight station speakers.

C (7) On ADF control panel; set ADF-1 (ADF-2) BFO/OFF switch
C to OFF.

C 1020-Hz tone signal is silenced.

C (8) On ADF control panel; set ADF-1 (ADF-2) ADF-OFF-ANT
C switch to ADF.

CR ADF pointers on RDDMIs unstow and indicate a
CR bearing when tuned to known station and station
CR audio is heard in flight station speakers. Do not
CR attempt to evaluate actual bearing indication.

CR NOTE: Flight line conduit, metal buildings,
CR poles, etc. have the ability to distort the
CR wave fronts of even strong local signals,
CR so R. F. bearing data is not reliable in
CR test environment. When sky wave is
CR received, erratic unpredictable bearing
CR data is normal and must be expected.
CR Generally, a ground wave only signal will
CR yield a stable but not necessarily accurate
CR bearing whereas sky wave bearings will be
CR erratic.

C D. Shutdown

C (1) On ADF control panel; set ADF-1 (ADF-2) ADF-OFF-ANT
C switch to OFF.

C (2) Shut down audio integrating system as follows:

C (a) Release ADF-1 (ADF-2) control on both Captains and
C First Officers audio selector panel.

C (b) Release SPKR control on Captains and First
C Officers audio selector panels.

C NOTE: If RANGE and/or VOICE controls were used,
C release.

C (3) Turn service interphone OFF (press and release SERVICE
C INTERPHONE - ON switchlight under FE/SO table).

C C C CAUTION: TURN INERTIALS TO OFF POSITION, INERTIAL BATTERIES WILL DISCHARGE UPON POWER REMOVAL IF INERTIALS ARE NOT SET TO OFF.

AUTOMATIC DIRECTION FINDER (ADF) RECEIVER REMOVAL AND INSTALLATION

1. Reference Procedure

34-57-00 ADF System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers ADF (D6) or ADF (D24). (Dual System Only).

(2) Open access doors 192N and 137AZ for access to mid electrical service center or enter mid electrical service center through access door in galley. Locate NO. 1 ADF receiver in left-hand equipment rack, shelf 2 (Dual System Only) (Ref. Fig. 401).

(3) Remove loop and sense antenna connectors from ADF receiver front panel receptacles.

(4) Loosen and disengage hold down extractor securing ADF receiver to mount.

NOTE: Excessive force is not required if ADF receiver multi-contact connector is fully disengaged in Step 2A(4) above.

(5) Slide ADF receiver forward until rear connector disengages from mating mount connector. Remove ADF receiver.

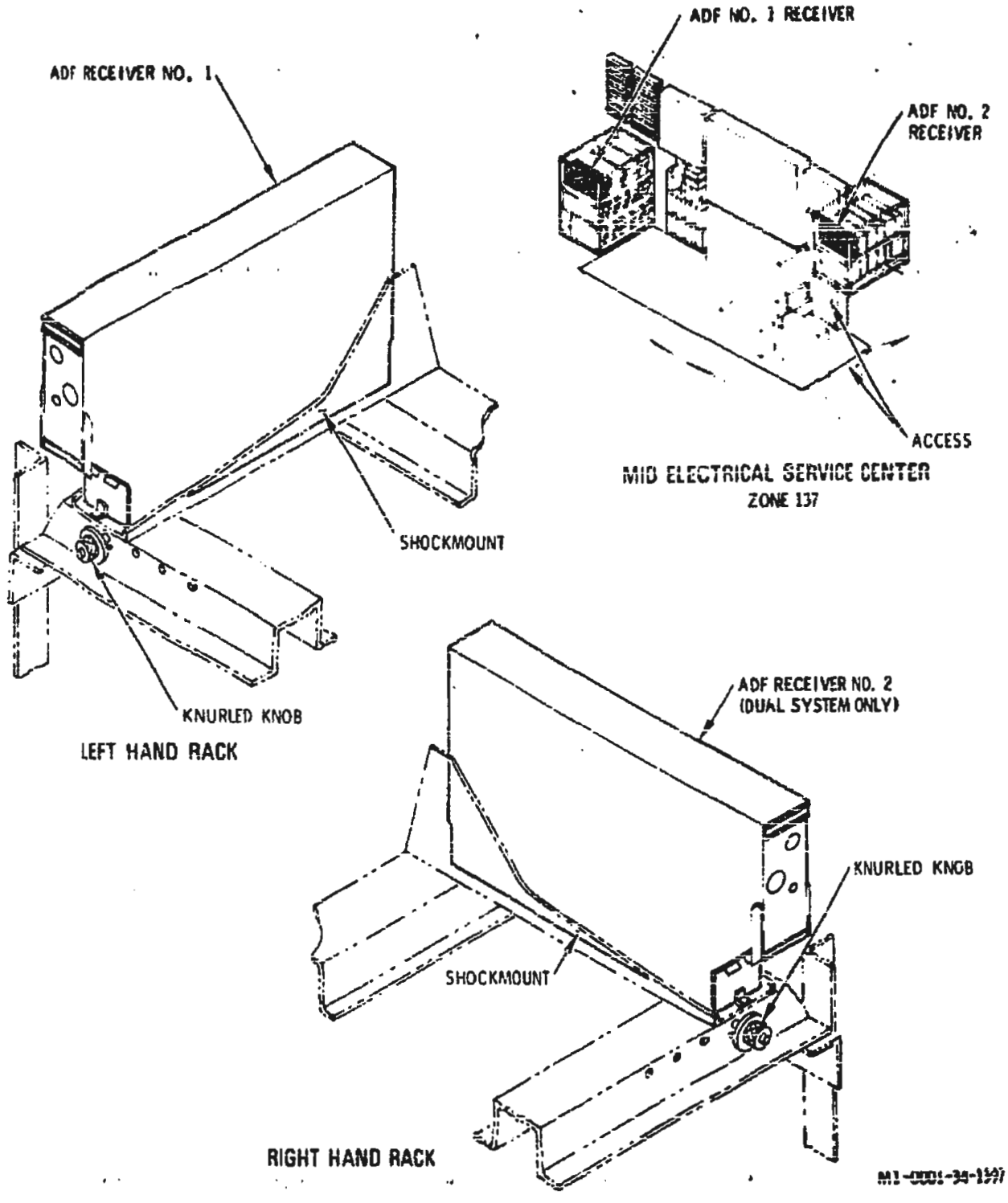
B. Installation

(1) Verify circuit breaker opened in Step 2A(1) is open and tagged.

(2) Position ADF receiver on mount and in top support channel and slide into place, aligning rear connector and mating mount connector.

(3) Place hold down extractor over ADF receiver hook. Tighten hold down extractor securing ADF receiver to mount. The unit is correctly tightened when

(a) The fluted knobs slip on their clutch, and



CR Automatic Direction Finder (ADF) Receiver
CR Removal and Installation
CR Figure 401

R R (b) The red band positioned between front of fluted knob and dome of holddown unit is no longer in view.

R (4) Connect loop and sense antenna connectors to ADF receiver front panel receptacles.

(5) Close and secure access door(s).

(6) Remove tag and close circuit breaker opened in Step 2A(1).

R R (7) Perform ADF system Operational Test (Self-Test) (Ref. 34-57-00, Page block 501).

AUTOMATIC DIRECTION FINDER (ADF) CONTROL PANEL REMOVAL AND INSTALLATION

1. Reference Procedure

34-57-00 ADF System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker ADF (D6) and RDDMI No. 1 (K25) or ADF (D24) and RDDMI-2 (J20) (Dual System Only). CR C

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker CTR CONSOLE PNL (E10).

(2) Locate ADF control panel on pilots center console, zone 210, (Ref. Fig. 401).

(3) Release Dzus fasteners securing ADF control panel to pilots center console.

(4) Pull ADF control panel from recess in pilots center console and disconnect connector from ADF control panel receptacle. Remove ADF control panel.

B. Installation

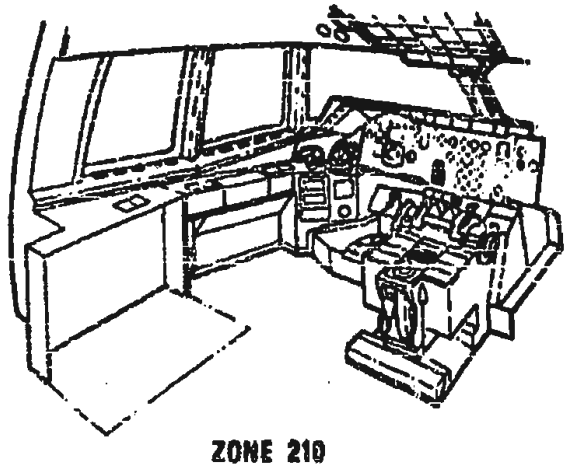
(1) Verify circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect connector to ADF control panel receptacle.

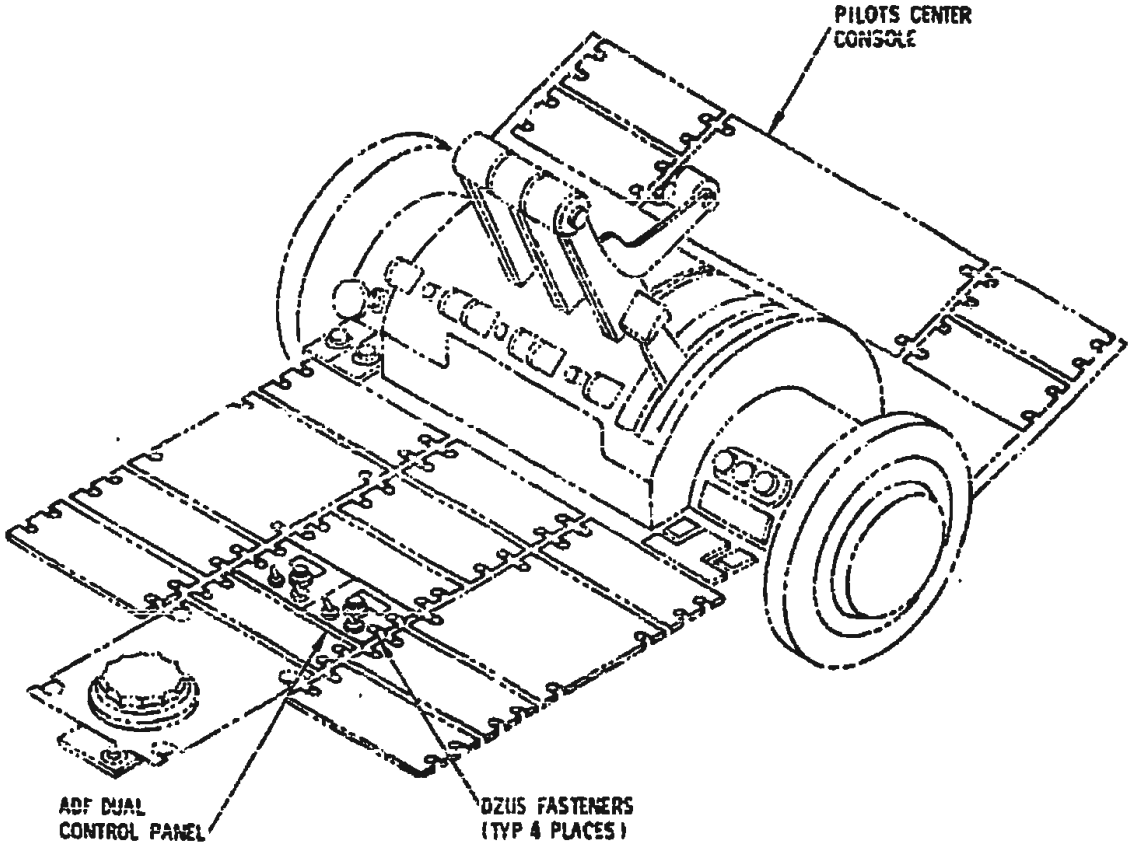
(3) Place ADF control panel in recess in pilots center console and secure with Dzus fasteners.

(4) Remove tags and close circuit breakers opened in Step 2A(1).

(5) Verify operation of new ADF control panel by tuning to local broadcast station. Check all controls for correct operation. If further testing is required, refer to ADF system adjustment and test (Ref. 34-57-00, page 501).



ZONE 210



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Automatic Direction Finder (ADF) Control Panel
Removal and Installation
Figure 401

AUTOMATIC DIRECTION FINDER SENSE ANTENNA REMOVAL AND INSTALLATION

1. Removal/Installation

A. Removal

(1) Locate two sense antennas on bottom of fuselage, zone 143.

(2) Remove screws located around outer edge of antenna panel and lower antenna panel.

(3) Remove bolts and center screw on selected sense antenna to release lightning arrestor.

R NOTE: Lightning arrestor is now secured only by antenna cable. If a sense antenna will not be installed promptly, disconnect lightning arrestor from antenna cable until a sense antenna is installed.

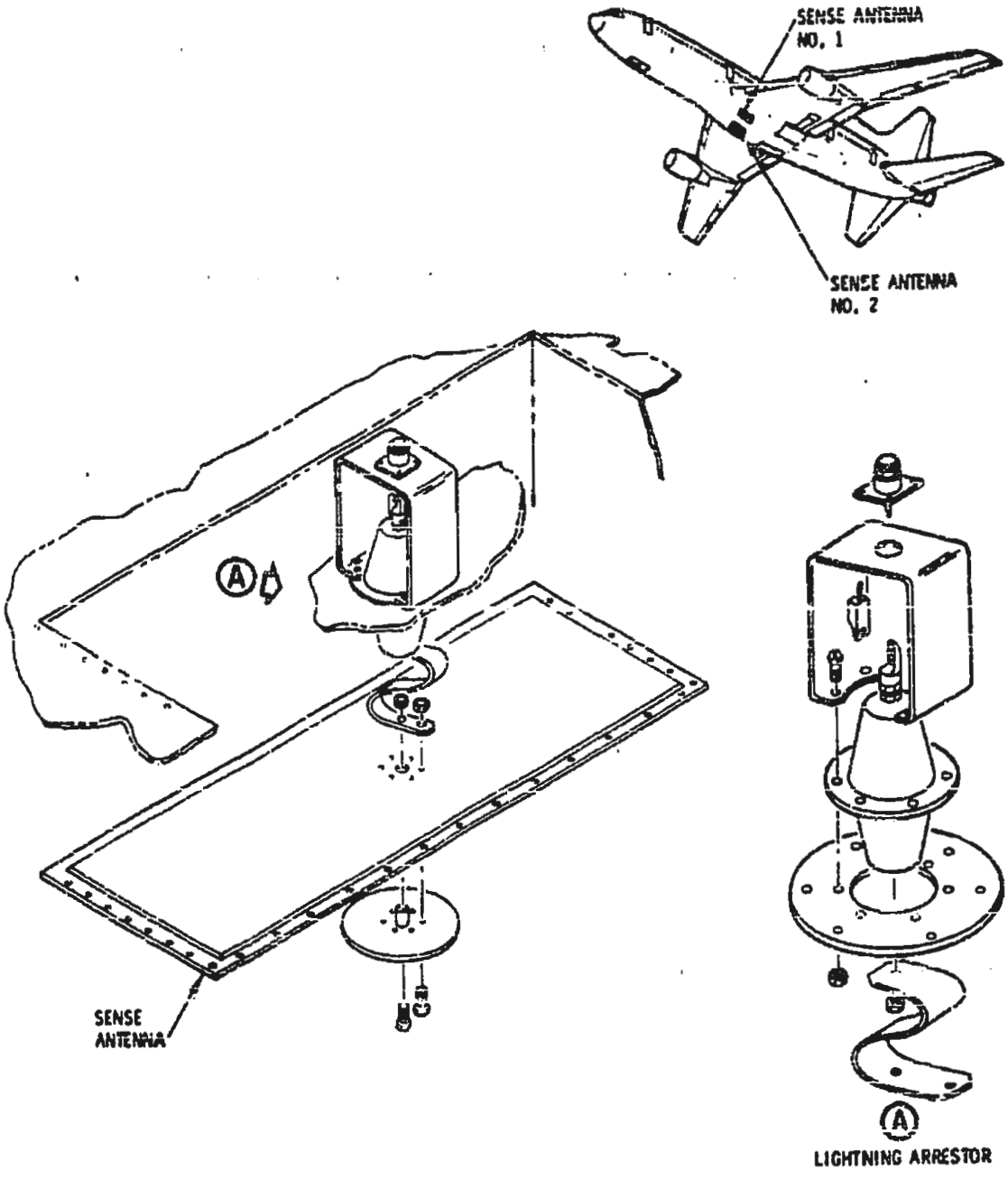
B. Installation

R (1) Verify lightning arrestor is connected to sense antenna cable.

(2) Install and tighten bolts and center screw securing lightning arrestor to sense antenna.

R (3) Position sense antenna on fuselage, install and tighten screws located around outer edge.

R (4) Verify operation of new sense antenna by tuning to
R known local station within frequency range of 190- to
R 1750 kHz if further testing is required, refer to ADF
R system adjustment and test (Ref. 34-57-00,501).



Automatic Direction Finder Sense Antenna
Removal and Installation
Figure 401

AUTOMATIC DIRECTION FINDER (ADF) SENSE ANTENNA REMOVAL AND INSTALLATION

1. Reference Procedure

34-57-00 ADF System - Adjustment and Test

51-25-00 Environmental Sealing

2. Equipment and Materials

Soft clean cloths

Gloves, disposable, MIL-G-36281 or equivalent

Plastic scraper

Solvent, Methy-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1, 1, 1, or equivalent

Aerodynamic sealant, PR 8501-K, or equivalent

Compound Sealing, LCM40-2180, Type I, or equivalent

3. Removal/Installation

A. Antenna Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker(s)ADF (D6) and/or ADF (D24) depending on sense antenna to be removed.

NOTE: Procedure applicable to both antenna No. 1 and No. 2.

(2) If applicable, remove dust barrier in order to enter MLG fairing area.

(3) Place suitable board and padding on structure in MLG fairing area to support personnel.

(4) Enter MLG fairing area and locate access cover outboard of ADF sense antenna coupler on antenna housing structure (Ref Fig. 401).

(5) Remove screws securing access cover and remove access cover.

(6) Remove sealant from access cover and antenna housing structure using plastic scraper.

R R R WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS, LUNG OR SKIN IRRITATION.

Using soft clean cloth moistened with trichloroethane solvent, clean access cover and antenna housing. Wipe dry with clean cloth before solvent dries.

(7) Working through access hole, remove nut securing jumper wire to antenna terminal screw and disconnect jumper wire.

(8) Remove screws securing antenna to antenna housing and remove antenna.

WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

KEEP MEK AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

(9) Remove sealant from edges of antenna housing with plastic scraper. Clean edges of antenna housing with a soft clean cloth moistened with methyl-ethyl-keytone solvent.

(10) If removing lightning arrestor, proceed to applicable portion of Paragraph 3C.

B. Antenna Installation

(1) If installing lightning arrestor, perform applicable portion of Paragraph 3D.

R WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS, LUNG OR SKIN IRRITATION.

(2) Clean faying surfaces of antenna housing and antenna panel with a soft clean cloth moistened with

trichloroethane solvent. Wipe dry with clean cloth before solvent dries.

R (3) Position antenna on antenna housing, install and tighten mounting screws (Ref. Fig. 401).

(4) Connect jumper wire to antenna terminal with screw and nut.

(5) Reinstall access cover and secure with screws.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

R (6) Wearing gloves, apply LCM40-2180, Type I sealant to access cover and screws (Ref. 51-25-00).

(7) Remove board and padding from MLG fairing area.

(8) If applicable, re-install dust barrier removed in Step 3A(2).

R (9) Wearing gloves, apply continuous aerodynamic seal along antenna panel butt joints using PR 8501-K sealant or equivalent (Ref. 51-25-00).

(10) Remove tag(s) and close circuit breaker(s) opened in Step 3A(1).

(11) Perform ADF system adjustment and test (Ref. 34-57-00).

C. Lightning Arrestor Removal

(1) Perform Steps 3A(1) and 3A(2).

(2) Place suitable board and padding on structure in MLG fairing area to support personnel.

R (3) Locate lightning arrestor access cover inside MLG fairing (Ref. Fig. 401).

(4) Remove screws securing lightning arrestor access cover and remove access cover.

R NOTE: Remove sealant. See Step 3A(6).

(5) Remove nut securing jumper wires to arrestor terminal. Disconnect jumper wires.

(6) Remove nut and washer securing arrestor to mounting plate. Remove arrestor.

D. Lightning Arrestor Installation

R R R WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN. PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS, LUNG OR SKIN IRRITATION.

(1) Clean faying surfaces of lightning arrestor and mounting plate with soft clean cloth moistened with trichloroethane solvent. Before solvent dries, wipe dry with clean cloth.

(2) R Position arrestor on mounting plate and secure with washer and nut (Ref. Fig. 401).

(3) Remove outer nut from arrestor terminal.

(4) Connect coupler and antenna jumper wires to arrester terminal and secure with washer and nut.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

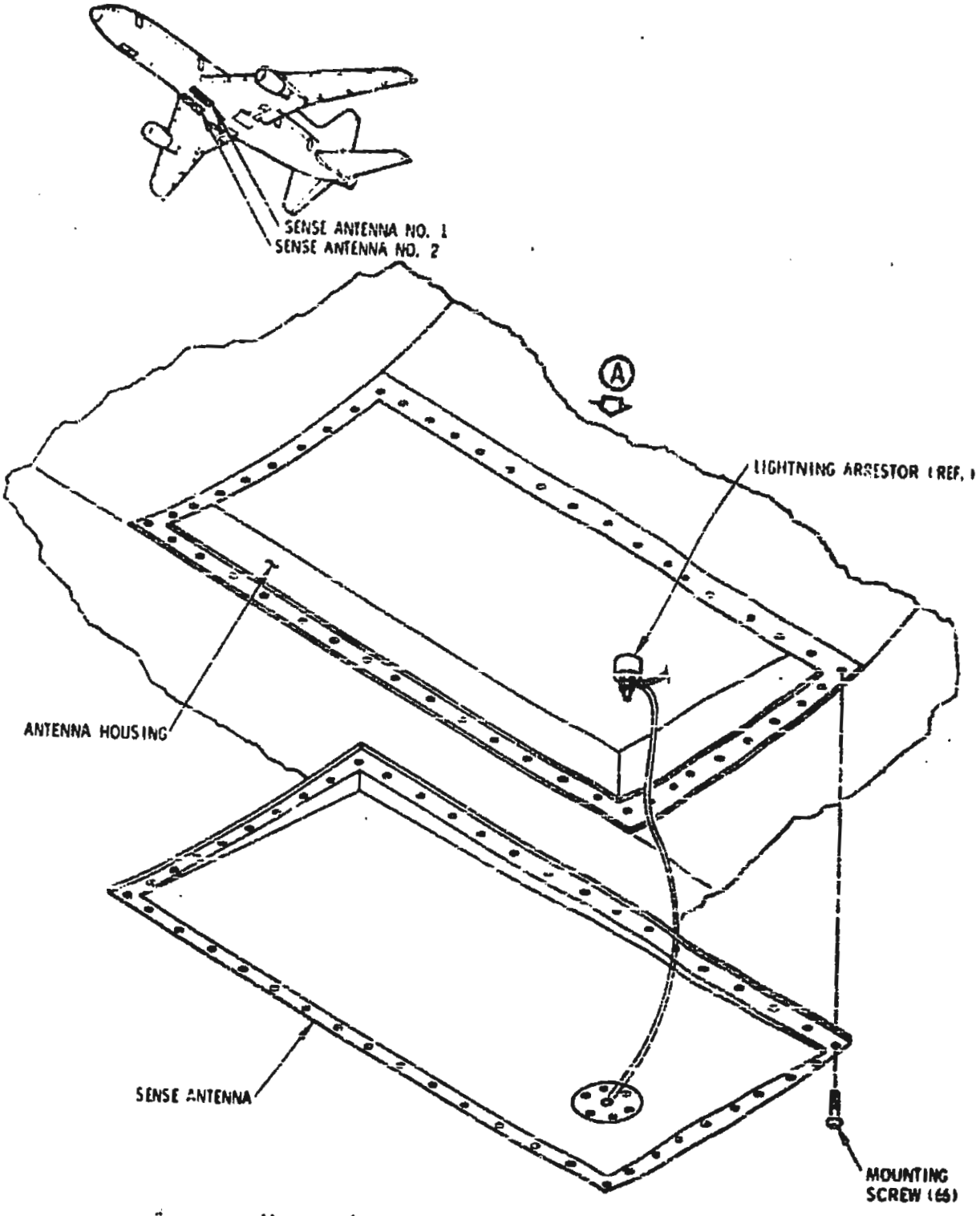
(5) Reinstall access cover and secure with screws.

R R (6) Wearing gloves, apply sealant to access cover and screws. See Step 3B(6).

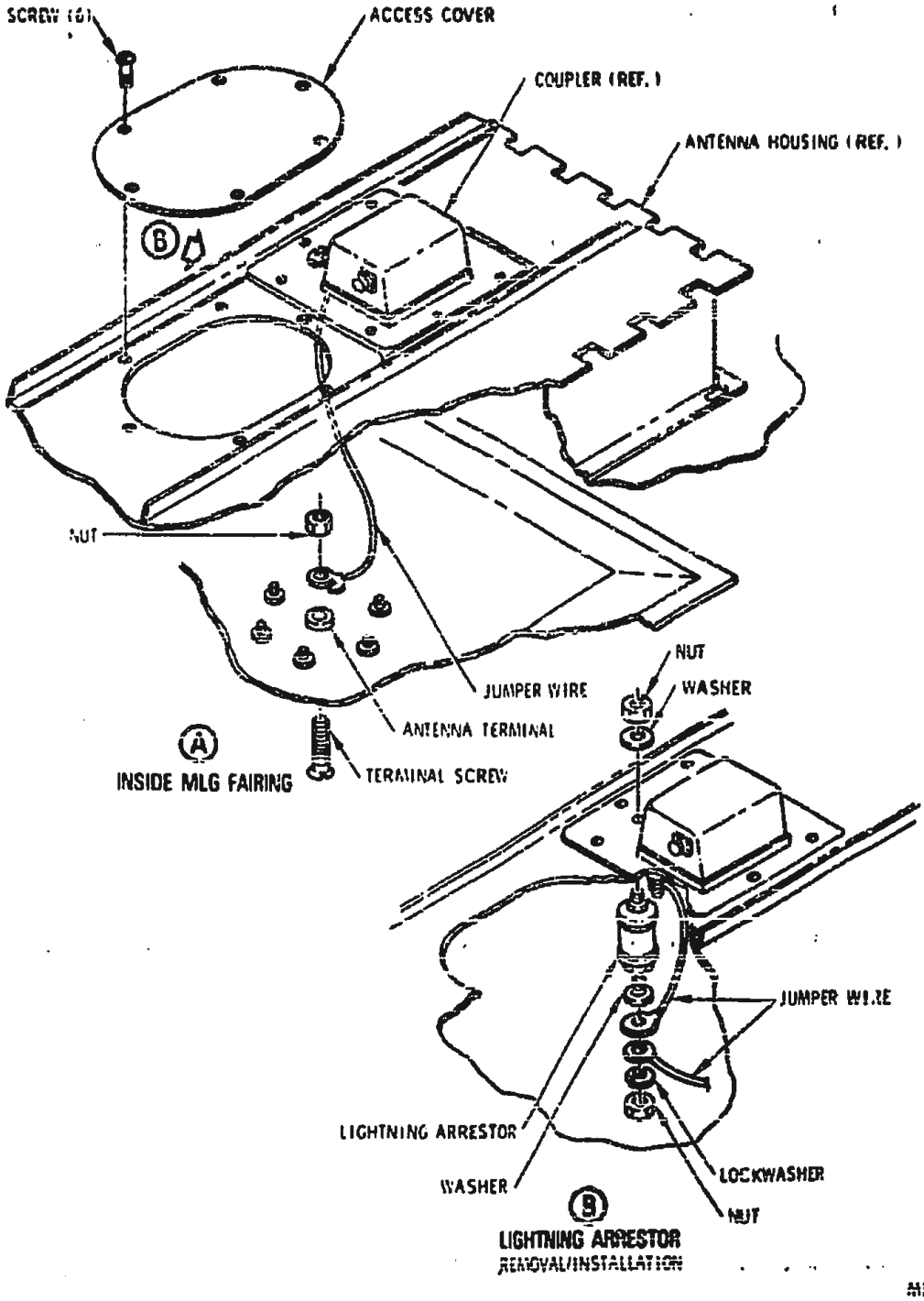
(7) Remove board and padding from MLG fairing area.

R (8) If applicable, re-install dust barrier.

R R R R (9) Verify operation of new sense antenna by tuning to local known station within the frequency range of 190- to 1750- kHz. If further testing is required, refer to ADF system adjustment and test (Ref. 34-57-00, 501).



Automatic Direction Finder (ADF) Sense Antenna
Removal and Installation
Figure 401 (Sheet 1)



Automatic Direction Finder (ADF) Sense Antenna
Removal and Installation
Figure 401 (Sheet 2)

R ADF SENSE ANTENNA - ANTENNA LEAD CONNECTOR
R CLEANING AND PAINTING

R 1. General

R This procedure outlines the cleaning/coating of the ADF Antenna
R lead connectors.

R 2. Equipment and Materials

R A. Antenna Lead Connector Cleaning

R Scotch Brite

R lint-free cloth

R B. Antenna Lead Connector Conductive Coating

R Polyurethane Silver Conductive Coating.

R 3. Maintenance Practices

R A. Antenna Lead Connector

R (1) Visually check antenna lead for corrosion.

R (2) Remove antenna lead as required.

R (3) Using scotch bright and clean cloth, remove residual
R deposits of dirt, corrosion, etc.

R (4) Flame spray for conductivity

R If cleaning of corrosion requires restoration of
R conductive area, restoration can be accomplished by
R using polyurethane silver conductive coating made by
R Dexter Midland per EPS 37-2880; per instructions in LCP
R 78-1133. An acceptable substitute is TEF7F69 made by
R Hexcel; per Boeing Manual BMS 8-278C.

R (5) Assemble as required.

AUTOMATIC DIRECTION FINDER (ADF) LOOP ANTENNA REMOVAL AND INSTALLATION

1. Reference Procedure

34-57-00 ADF System - Adjustment and Test

51-25-00 Environmental Sealing

2. Equipment and Materials

Soft clean cloths

Gloves, disposable, MIL-G-36281 or equivalent

Plastic scraper

Solvent, Methyl-Ethyl-Keytone, Fed Spec TT-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

C Environmental seal, non-conductive aluminum colored polysulfide
C sealant (LAC Spec C-40-1279), Mfr P/N PR1436G-B2, TWA Stk Nbr
C 50-1188)

3. Removal/Installation

A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag circuit breaker(s) NO. 1 NAVIGATION ADF
C (D6) or NO. 2 NAVIGATION-ADF (D24). (Dual System
C only)

R (2) Locate loop antenna(s) on bottom of fuselage, zone 142 (Ref. Fig. 401).

(3) Enter hydraulic service center (access door 147B),
R locate and release clamp mounted on spacer securing antenna cable of antenna to be removed.

(4) Remove screws securing selected loop antenna to fuselage.

(5) Lower loop antenna to obtain access to quadrantal error corrector.

(6) Remove quadrantal error corrector (with loop antenna cable attached) from loop antenna receptacle.

(7) Remove loop antenna along with loop antenna gasket. To prevent loss of gasket, attach to loop antenna.

WARNING: USE METHYL-ETHYL-KETONE (MEK) IN WELL-VENTILATED AREA. AVOID FLUID CONTACT WITH SKIN AND EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.

KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME. FAILURE TO COMPLY MAY RESULT IN MATERIAL COMBUSTION.

(8) Use plastic scraper to remove sealant from fuselage structure. Using soft clean cloth moistened with methyl-ethyl-keytone solvent, clean fuselage structure.

B. Installation

R (1) Verify circuit breaker(s) opened in Step 3A(1) are open
R and tagged.

WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO
R NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN.
R PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS,
R LUNG OR SKIN IRRITATION.

(2) Using clean soft cloth moistened with trichloroethane solvent, clean faying surfaces of fuselage skin and ADF antenna mounting plate. Before cleaning solvent dries, wipe dry with clean cloth.

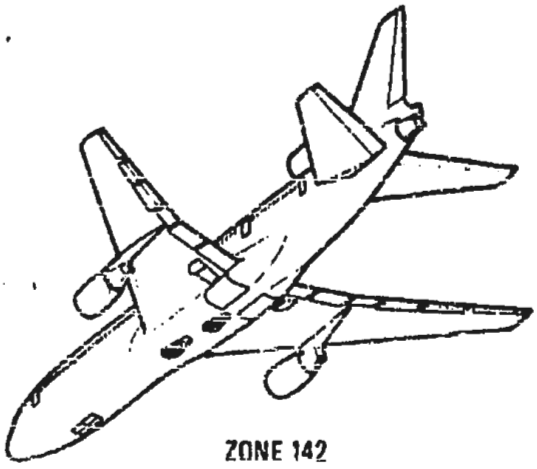
(3) Install quadrantal error corrector (with loop antenna cable attached) on loop antenna receptacle.

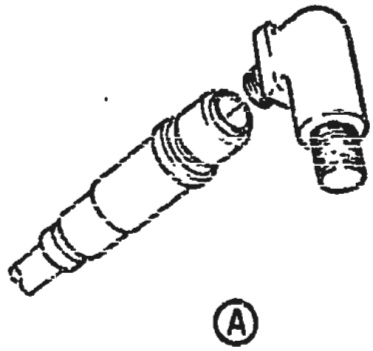
R (4) Position ADF loop antenna gasket on loop antenna, align antenna and fuselage mounting holes.

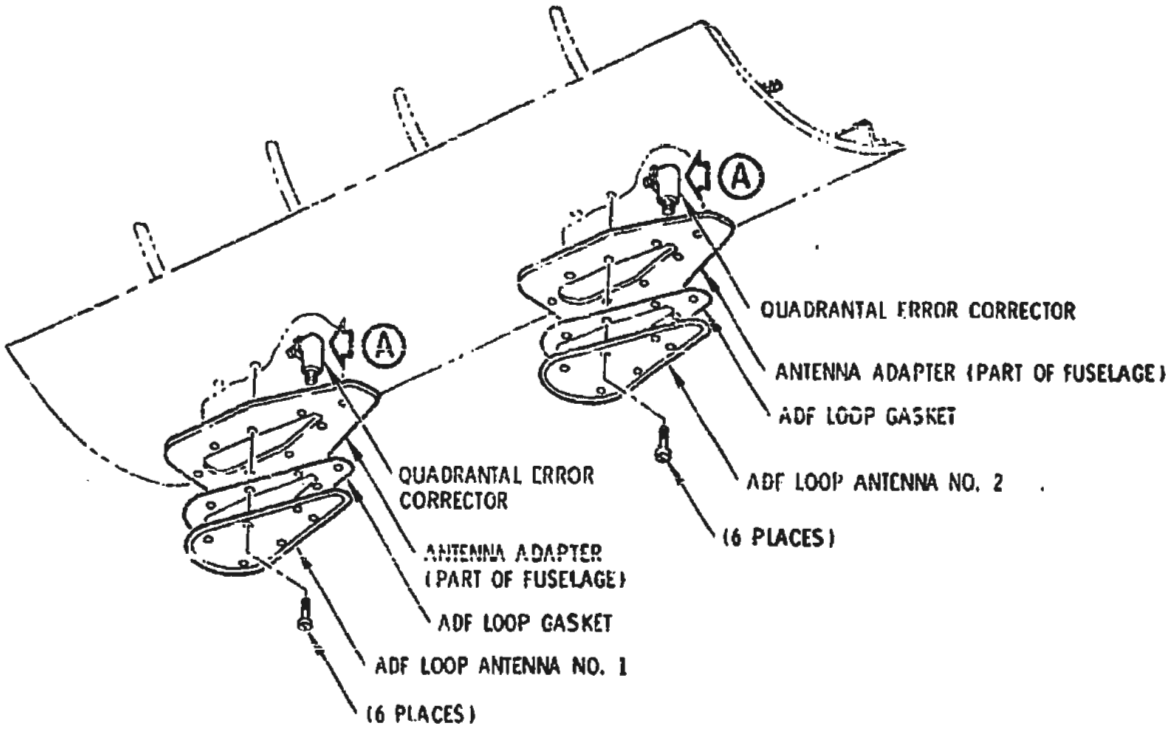
(5) Install and tighten screws securing loop antenna to bottom of fuselage.

(6) Enter hydraulic service center (access door 147AB),
R locate antenna cable attached to quadrantal error corrector on loop antenna. Secure antenna cable using clamp and spacer. Close and secure access door 147AB.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES. PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE IRRITATION.







MI-0101-34-244

Automatic Direction Finder (ADF) Loop Antenna
Removal and Installation
Figure 401

R EFFECTIVITY: ALL
R
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(7) Wearing gloves, apply a continuous sealant fillet between ADF antenna mounting plate and fuselage using Environmental Sealant, LAC Spec C-40-1279 or equivalent (Ref. 51-25-00).

(8) Remove tags and close circuit breakers opened in Step 3A(1).

(9) Prepare ADF system for operation and tune to known local station within frequency range 190- to 1750- kHz.

R (10) If ADF pointers swing to a bearing indication when
R tuned to any station of adequate signal strength, ADF
R system is operational. Do not attempt to evaluate
R actual bearing indication.

R NOTE: Flight line conduit, metal buildings, poles,
R etc. have the ability to distort the wave fronts
R of even strong local signals, so R. F. bearing
R data is not reliable in test environment. When
R sky wave is received, erratic unpredicatable
R bearing data is normal and must be expected.
R Generally, a ground wave only signal will yield
R a stable but not necessarily accurate bearing
R whereas sky wave bearings will be erratic.

AUTOMATIC DIRECTION FINDER (ADF) QUADRANTAL ERROR CORRECTOR REMOVAL AND INSTALLATION

1. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 NAVIGATION - ADF (D6) or No. 2 NAVIGATION - ADF (D26). (Dual System only).

(2) Enter hydraulic service center through access door 147AB, locate quadrantal error corrector to be removed.

(3) Remove loop antenna cable from quadrantal error corrector.

(4) Disconnect and remove quadrantal error corrector from loop antenna receptacle.

B. Installation

(1) Verify circuit breaker(s) opened in Step 2A(1) are open and tagged.

(2) Working in hydraulic service center; install quadrantal error corrector on loop antenna receptacle (Ref. Fig. 401).

(3) Connect loop antenna cable to quadrantal error corrector.

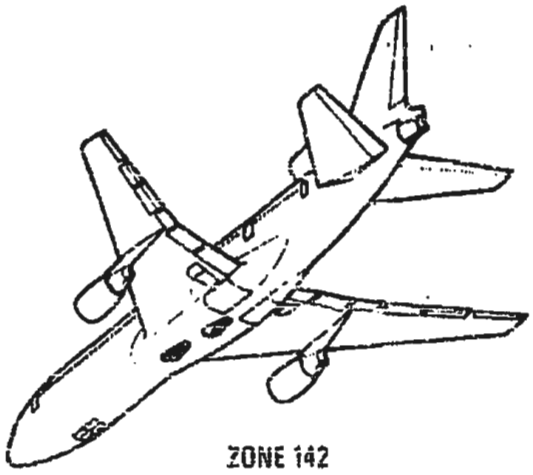
(4) Close and secure access door 147AB.

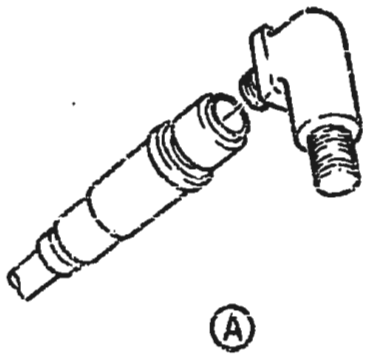
(5) Remove tags and close circuit breaker(s) opened in Step 2A(1).

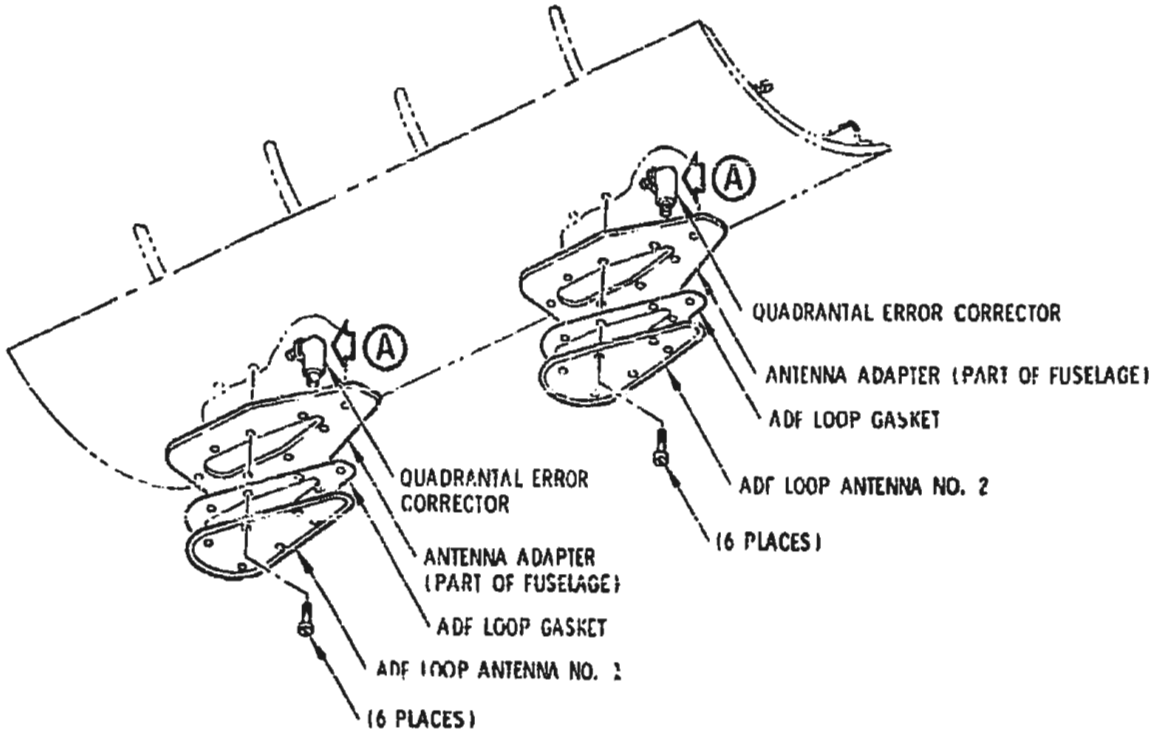
NOTE: Verify loop antenna does not require realignment of installed quadrantal error corrector to operate in ADF system.

(6) Prepare ADF system for operation and tune to known local station within frequency range of 190-to 1750-kHz.

(7) If ADF pointers swing to a bearing indication when tuned to any station of adequate signal strength, ADF system is operational. Do not attempt to evaluate actual bearing indication.







M1-0101-34-244

R Automatic Direction Finder (ADF) Quadrantal Error Corrector
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

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R NOTE: Flight line conduit, metal buildings, poles,
R etc. have the ability to distort the wave fronts
R of even strong local signals, so R. F. bearing
R data is not reliable in test environment. When
R sky wave is received, erratic unpredictable
R bearing data is normal and must be expected.
R Generally, a ground wave only signal will yield
R a stable but not necessarily accurate bearing
R whereas sky wave bearings will be erratic.

RADIO DIGITAL DISTANCE MAGNETIC INDICATOR (RDDMI) REMOVAL AND INSTALLATION

1. Referenced Procedures

24-00-00 Electrical Power - Maintenance Practices

34-22-00 Magnetic Heading Reference System - Adjustment and Test

34-51-00 DME System - Adjustment and Test

34-55-00 VOR System - Adjustment and Test

34-57-00 ADF System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

NO. 1 NAV & INSTRF/O RDDMI (E3)

NO. 2 NAV & INSTR - CAPT RDDMI (E20)

R 26 VAC NAV EXCITATION - RDDMI 2 (J20)

R RDDMI 1 (K20)

NO. 1 NAVIGATION - ADF (D6)

NO. 2 NAVIGATION - ADF (D24)

NO. 1 NAVIGATION - VHF DC - VOR RCVR (G1)

NO. 2 NAVIGATION - VHF-DC - VOR RCVR (G19)

NO. 1 NAVIGATION - DME (D5)

NO. 2 NAVIGATION - DME (D23)

NO. 1 NAVIGATION - CMPS COUPLER (G7)

NO. 2 NAVIGATION - CMPS CPLR (G26)

5 VAC INSTRUMENT LIGHTING - CAPT L (L20)

(2) Locate Captains RDDMI on Captains instrument panel, zone 211, or First Officers RDDMI on First Officers instrument panel, zone 212, (Ref. Fig. 401).

(3) Loosen clamp screws securing RDDMI to Captains or First Officers instrument panel.

(4) Pull RDDMI out of recess in Captains or First Officers instrument panel and disconnect electrical connector from RDDMI receptacles. Remove RDDMI.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) On FE/SO overhead circuit breaker panel C32, zone 215, verify INSTR COOLING (A21) circuit breaker is closed.

(3) Turn on electrical power (Ref. 24-00-00).

(4) Reach through instrument panel opening and feel for air flow from instrument cooling system.

(5) Air flow is from tube at upper right corner of instrument opening (ADI clamp).

(6) Connect electrical connectors to RDDMI receptacles.

(7) Place RDDMI into recess in Captains or First Officers instrument panel.

(8) On face of instrument panel, torque clamp adjusting screws to 5 to 8 lb in.

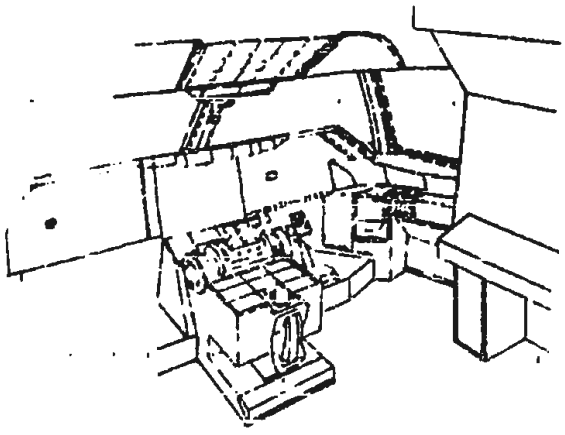
(9) Remove tags and close circuit breakers opened in Step 2A(1).

R (10) Check that the heading flag is out of view and that the
R compass card indicates present airplane magnetic
R heading.

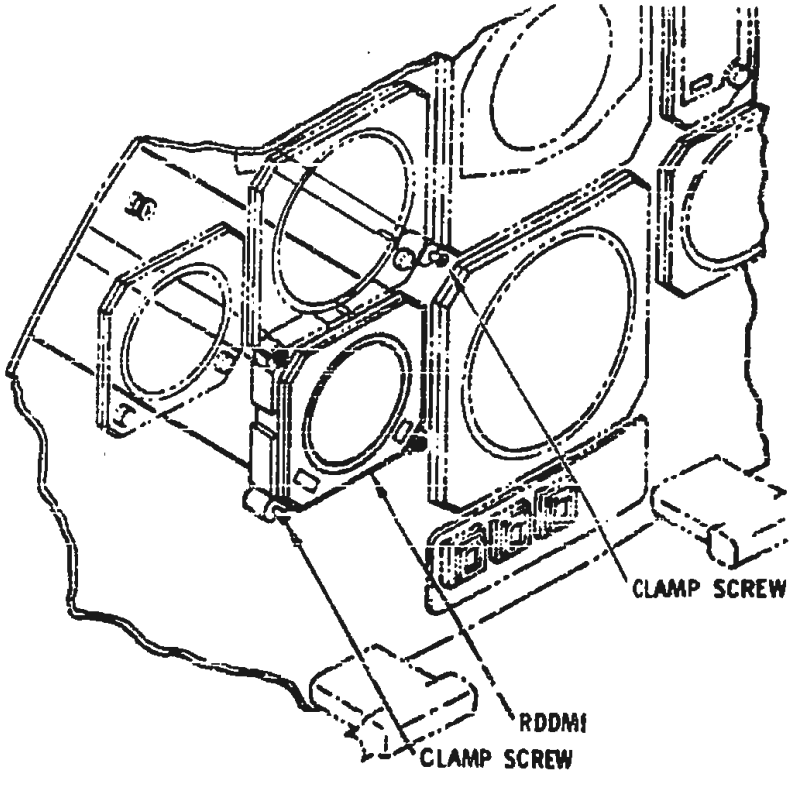
(11) Perform DME system BITE test procedure (Ref. 34-51-00).

(12) Perform VOR system BITE test procedure (Ref. 34-55-00).

R (13) Operationally check that both pointers indicate
R properly on ADF by selecting ADF using the VOR/ADF
R selector switches on the indicator and tuning the
R ADF(s) to a local station.



FLIGHT STATION
ZONE 211



MI-1101-34-216

R Radio Digital Distance Magnetic Indicator (RDDMI)
R Removal and Installation
R Figure 401

AUTOMATIC DIRECTION FINDER (ADF) SENSE ANTENNA COUPLER REMOVAL AND INSTALLATION

1. Reference Procedure

   34-57-00 ADF System - Adjustment and Test

   51-25-00 Environmental Sealing

2. Equipment and Materials

   Board and Padding

   Gloves, disposable, MIL-G-36281 or equivalent

   Soft clean cloths

   Solvent, Trichloroethane, Fed Spec O-T-620 1, 1, 1, or equivalent

   Compound Sealing, LCM40-2180, Type I, or equivalent

3. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers(s) ADF (D6) and/or ADF (D24) depending on sense antenna coupler to be removed.

      (2) If applicable, remove dust barrier in order to enter main landing gear (MLG) fairing area.

      (3) Place suitable board and padding on structure in MLG fairing to support personnel.

      (4) Enter MLG fairing area, locate ADF sense antenna coupler (Ref. Fig. 401).

      (5) Disconnect electrical connector from coupler.

      (6) Remove screws securing coupler mounting plate to antenna housing.

      NOTE: Do not apply excessive tension to antenna jumper wire.

(7) Lift up assembly and remove nut securing jumper wire to coupler terminal and disconnect jumper wire.

(8) Remove screws securing coupler to mounting plate and remove coupler.

WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO
R NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN.
R PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS,
R LUNG OR SKIN IRRITATION.

(9) Remove sealant from antenna housing, coupler and mounting plate using plastic scraper. Use soft clean cloth moistened with trichloroethane solvent to wipe antenna housing, coupler and mounting plate clean. Wipe dry with clean cloth before solvent dries.

B. Installation

WARNING: USE TRICHLOROETHANE IN WELL-VENTILATED AREA. DO
R NOT INHALE VAPOR, AVOID FLUID CONTACT WITH SKIN.
R PROLONGED EXPOSURE MAY RESULT IN UNCONSCIOUSNESS,
R LUNG OR SKIN IRRITATION.

(1) Remove paint from coupler and mounting plate screw hole recesses and faying surfaces. Clean screw hole recesses and faying surfaces of coupler and mounting plate using soft clean cloth moistened with trichloroethane solvent. Wipe dry with clean cloth before cleaning solvent dries.

(2) Position coupler on mounting plate and secure with mounting screws (Ref. Fig. 401).

(3) Remove outer nut from coupler terminal.

(4) Connect arrestor-to-coupler jumper wire to coupler terminal and secure with nut.

(5) Position assembly on antenna housing and secure with screws.

WARNING: DO NOT ALLOW SEALANT TO CONTACT SKIN OR EYES.
PROLONGED EXPOSURE MAY RESULT IN SKIN OR EYE
IRRITATION.

(6) Wearing gloves, apply LCM40-2180, Type I sealant to
R coupler/mount installation on antenna housing (Ref.
R 51-25-00).

(7) Connect electrical connector to coupler.

(8) Remove board and padding from MLG fairing.

(9) If applicable, re-install dust barrier removed in Step 3A(1).

(10) Remove tag(s) and close circuit breaker(s) opened in Step 3A(1).

(11) Prepare ADF system for operation and tune to known local station within frequency range of 190- to 1750-kHz.

R (12) If ADF pointers swing to a bearing indication when
R tuned to any station of adequate signal strength, ADF
R system is operational. Do not attempt to evaluate
R actual bearing indication.

R NOTE: Flight line conduit, metal buildings, poles,
R etc. have the ability to distort the wave fronts
R of even strong local signals, so R. F. bearing
R data is not reliable in test environment. When
R sky wave is received, erratic unpredictable
R bearing data is normal and must be expected.
R Generally, a ground wave only signal will yield
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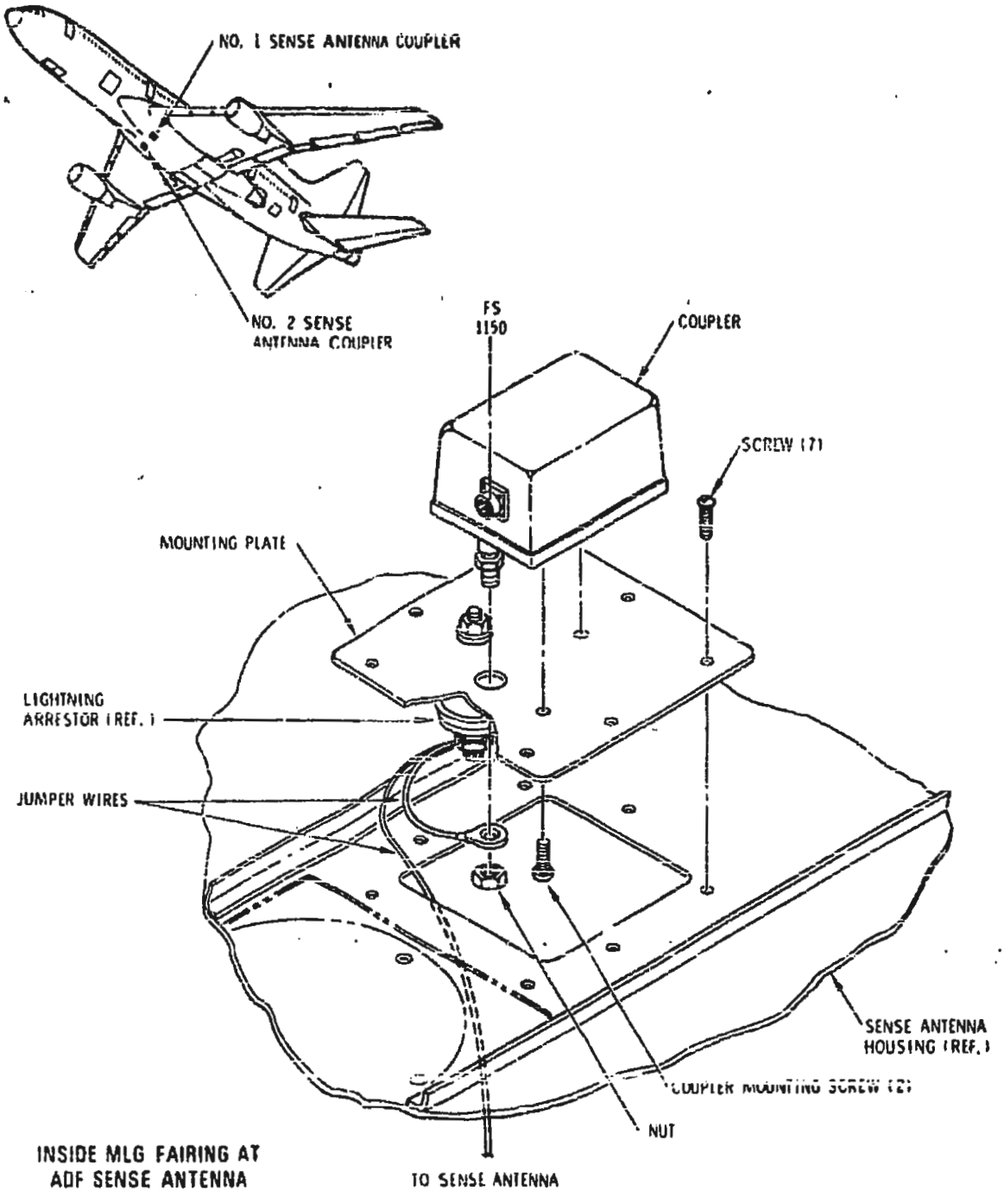


Automatic Direction Finder (ADF) Sense Antenna Coupler
Removal and Installation
Figure 401

CR

OMEGA NAVIGATION SYSTEM - DESCRIPTION AND OPERATION

CR 1. General

CR The Omega Navigation System automatically determines the
CR aircraft position over the surface of the earth by means of very
CR low frequency Omega Stations, maintained by the Coast Guard and
CR VLF low frequencies stations, maintained by the Navy. The
CR system navigates in a rho, rho, rho method by computing
CR simultaneously the distance to each of its received stations and
CR choosing those lines of position optimized for their location on
CR the earth. Then it deletes those stations which have redundant
CR signal paths or paths from the opposite direction around the
CR world.

CR The Omega Navigation Systems depend on aircraft heading, from
CR the aircraft compass system and true air speed from the
CR aircrafts Central Air Data Computer (CADC) system. The Omega
CR Navigation System utilizes a loop antenna, mounted on the
CR underside of the aircraft at FS-635. The output of the Omega
CR Navigation Systems is ground speed, distance and time in a
CR digital format on the pilot's horizontal situation indicator
CR (HSI) and course deviation, to/from, and synthetic MAG heading
CR to the HSI display. The Omega Navigation System also supplies
CR to the autopilot systems right or left steering command and
CR validity signals permitting the No. 1 Omega System steering to
CR the "A" channel of the autopilot and for the No. 2 Omega System,
CR steering to the "B" channel of the autopilot.

CR 2. System Description

CR The Omega Navigation System (ONS), contains a series of phase
CR sensitive receiver cards to enable the system to monitor the
CR Omega Navigation format as well as a separate channel for very
CR low frequency stations. The system then measures the zero
CR crossing intervals between each of the transmitted Omega station
CR frequencies as well as supplementally computing the zero
CR crossing of the very low frequency communication stations and
CR arrives at present position by an accurate phase measurement by
CR each of these lines of position. A high speed digital computer
CR located in the RPU provides control of the information coming
CR from the receiver processor. It also processes the navigation
CR equation and monitors the output to the flight director and the
CR autopilot.

CR Additionally, an extremely stable, temperature compensated
CR Quartz crystal oscillator (TXCO) is utilized in the receiver for
CR precise phase measurements on each of the incoming ground
CR station signals. Significant alignment time can be devoted to

CR the computer waiting for the crystal oven up to temperature
CR discrete. This point can be made more obvious by inadvertently
CR storing an omega system in an unheated location overnight, or
CR cold soaking an aircraft on a snow covered winter night.

CR Ground station geometry permitting, a stable oscillator will
CR permit the Omega to operate on as few as two ground stations.

CR The Omega Navigation System is characterized by the following
CR features:

CR A. Automatic calibration is accomplished each time the Omega
CR System is turned on. The system monitors its own
CR performance and furnishes warning indications when output
CR signals or interface signals are unreliable. Insertion of
CR present position, way point and destination data is easily
CR accomplished by using the keyboard on the CDU.

CR B. This system operates accurately within any latitude or
CR longitude encounted in flight, including polar flights.

CR C. All Omega indicator light and displays should be operative
CR and replaced with the Omega control display unit in the OFF
CR position.

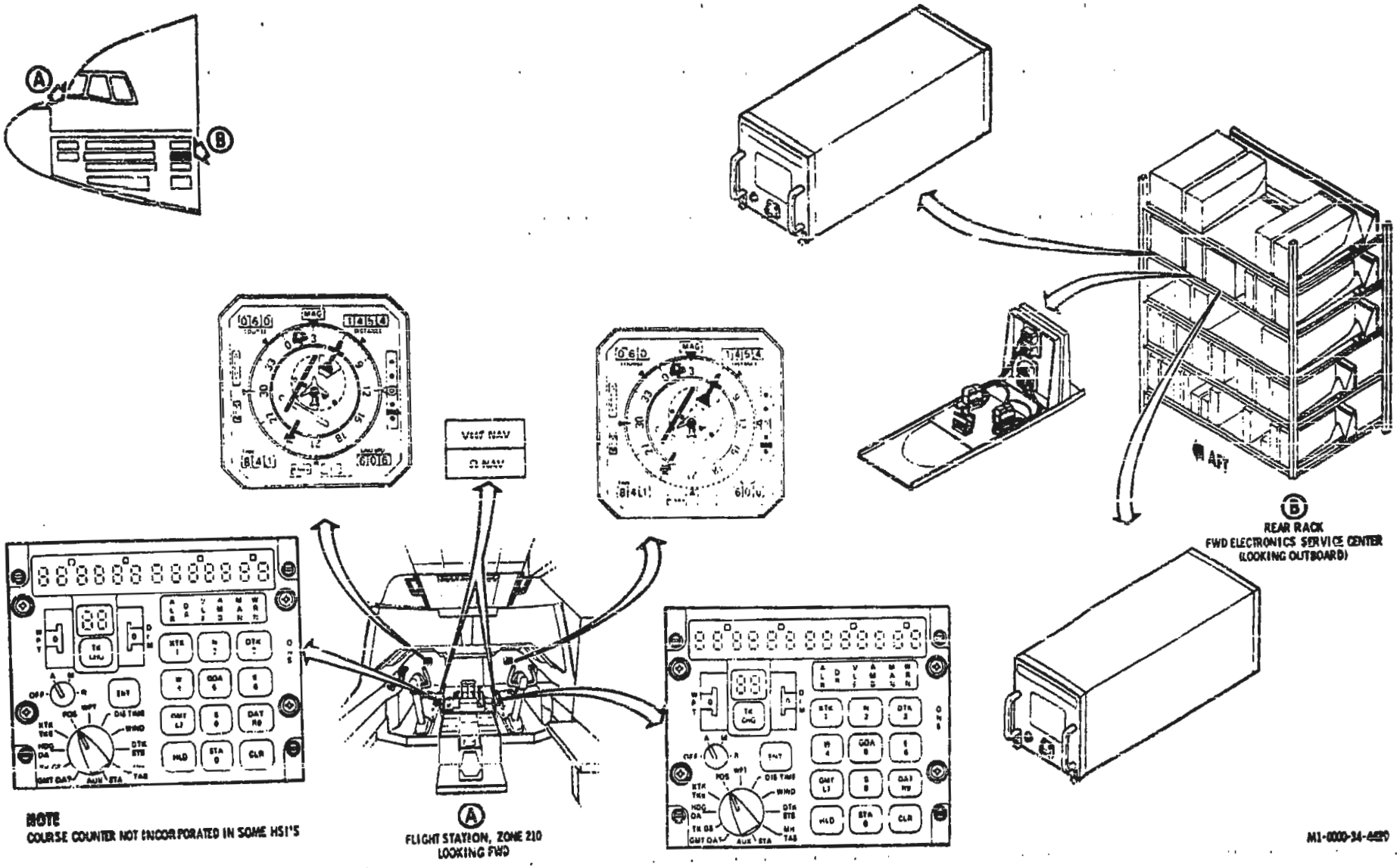
CR D. The Central Air Data Computer (CADC) and heading from the
CR Magnetic Heading Reference (MHRS) System are inputs to the
CR Omega Navigation System. Loss of these inputs will not
CR seriously effect the Omega Navigation System due to the
CR ability of the Control Display Unit to provide key Omega
CR Navigation.

CR E. Omega navigation accuracy is significantly improved by
CR position fixing when accurate present position data is
CR available.

CR Should the Omega System be turned OFF in flight, a procedure
CR exists to re-lane the Omega System by a rough approximation of
CR system position permitting the computer to refine that position
CR over a period approximately five (5) to ten (10) minutes.

CR 3. Environmental Considerations

CR An aircraft Omega installation deserves special attention to the
CR location and bonding of the external antennas. Considerable
CR time was spent in the measurement and installation of the
CR antennas' location on this L-1011. Internal aircraft induced
CR magnetically sensed fields are generated by the electrical
CR generators and power distribution system.



NOTE
COURSE COUNTER NOT INCORPORATED IN SOME HSI'S

Omega System Layout
Figure 1

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CR
R EFFECTIVITY: ALL
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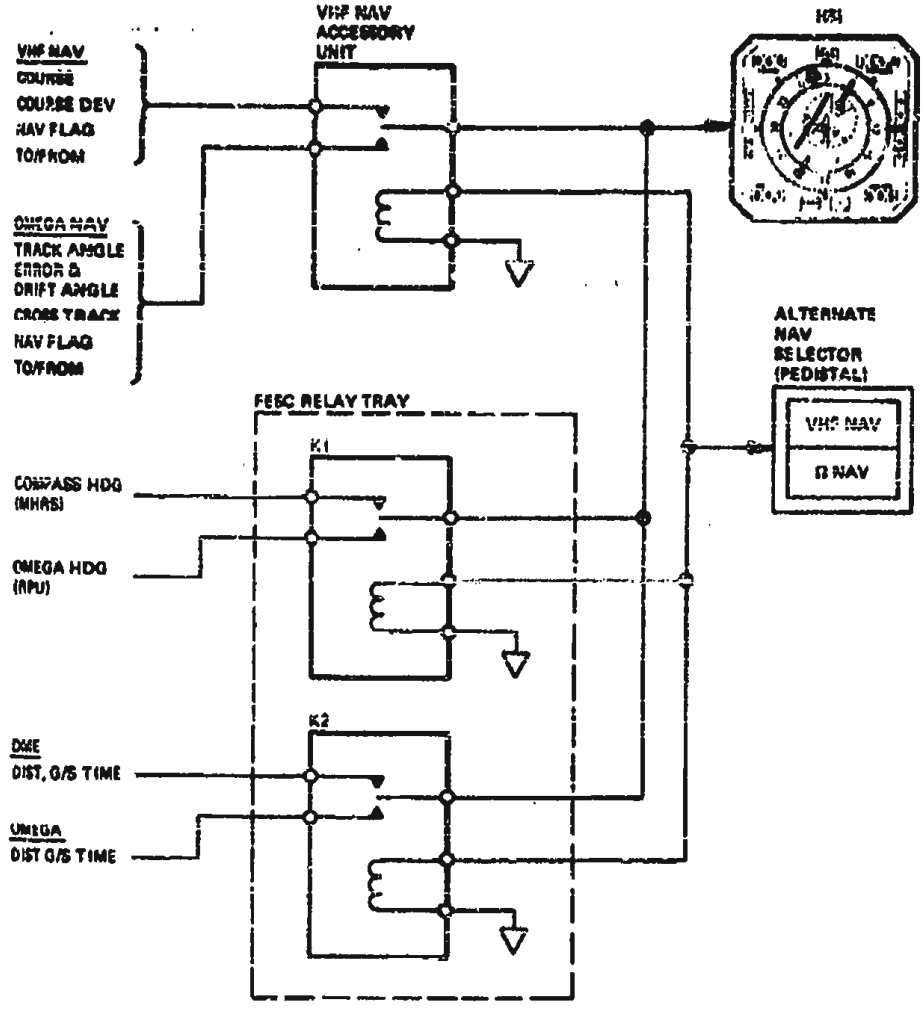

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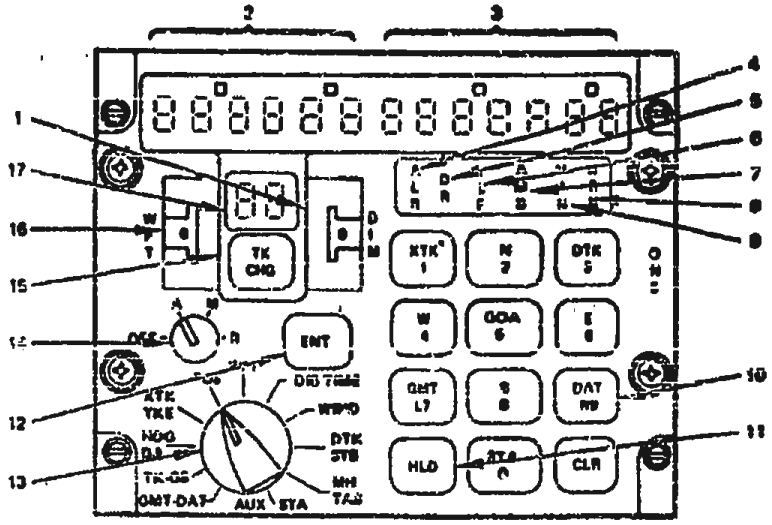
System Block Diagram
Figure 2

R
R
003B

EFFECTIVITY: ALL



ITEM NO.	NOMENCLATURE	FUNCTION
1	DIM CONTROL	WHEN ROTATED UPWARD, REDUCES INTENSITY OF LEFT (2), RIGHT (3), AND FROM/TO (17) DISPLAYS. WHEN ROTATED DOWNWARD, INCREASES INTENSITY OF DISPLAYS.
2	LEFT DISPLAY	DISPLAYS DATA SELECTED BY DISPLAY SWITCH (13).
3	RIGHT DISPLAY	DISPLAYS DATA SELECTED BY DISPLAY SWITCH (13).
4	ALR (ALERT) ANNUNCIATOR (AMBER)	COMES ON WHEN AIRCRAFT IS TWO MINUTES FROM NEXT WAYPOINT. IF MODE SWITCH IS SET TO A, GOES OUT WHEN TRACK LEG CHANGE OCCURS; IF MODE SWITCH IS SET TO M, FLASHES WHEN AIRCRAFT IS ONE-HALF MINUTE FROM NEXT WAYPOINT AND CONTINUES TO FLASH UNTIL MANUAL TRACK LEG CHANGE IS MADE.

M1-1000-34-6431

CR CR Controls, Annunciators, and/or Indicators for ONS CDU
Figure 3 (Sheet 1)

ITEM NO.	NOMENCLATURE	FUNCTION
6	DEAD RECKONING (DR) ANNUNCIATOR (AMBER)	COMES ON DURING INITIALIZATION SEQUENCE OR IF SYSTEM OMEGA NAVIGATION CAPABILITY IS LOST. EXTINGUISHES WHEN SYSTEM ENTERS NAVIGATION MODE.
7	VERY LOW FREQUENCY (VLF) ANNUNCIATOR (AMBER)	COMES ON WHENEVER THE SYSTEM IS OPERATING WITH SIGNALS FROM VLF STATIONS AS THE PRIMARY NAVIGATION SOURCE.
7	AMBIGUITY (AMB) ANNUNCIATOR (AMBER)	COMES ON WHEN AN OMEGA POSITION AMBIGUITY IS DETECTED. EXTINGUISHES WHEN AMBIGUITY DISAPPEARS.
8	MANUAL DATA ENTRY (MAN) ANNUNCIATOR (AMBER)	COMES ON WHEN MANUAL ENTRY FOR TAS, MH, AND XTK OFFSET IS MADE BY THE OPERATOR. REMAINS LIT UNTIL ALL MANUAL ENTRIES HAVE BEEN ZEROED OUT BY THE OPERATOR.
9	WARN (WRN) ANNUNCIATOR (RED)	WHEN STEADY INDICATES SYSTEM FAILURE HAS BEEN DETECTED BY THE INTEGRITY MONITORING FUNCTION. WHEN FLASHING INDICATES INSUFFICIENT DATA ENTERED BY OPERATOR, TAS OR MH BECOMES INVALID, OR AFTER A POWER FAILURE OF BETWEEN SEVEN SECONDS AND SEVEN MINUTES. FLASHES WHEN ACTION CODES 1 OR 2 ARE DISPLAYED, BUT NOT ACTION CODE 3. NOTE: WHEN ANNUNCIATORS (4) THROUGH (9) ARE EXTINGUISHED, THE SYSTEM IS FUNCTIONING THE THE NORMAL OMEGA NAVIGATION MODE.
10	CLR PUSHBUTTON	CLEARS DISPLAYED DATA IF NOT YET ENTERED, CLEARS SYSTEM IF ERROR IS MADE IN DATA ENTRY ROUTINE, AND REMOVES FLASHING WRN LIGHT FOR ACTION CODES 1 OR 2.
11	HLD PUSHBUTTON	PERMITS POSITION CHECK, EDITING OF WAYPOINT SEQUENCE, POSITION UPDATE, WAYPOINT EDITING, REVIEW OF SYSTEM MALFUNCTION, AND RELEASE OF UPDATED INFORMATION AFTER POWER INTERRUPTS.
12	ENT PUSHBUTTON	WHEN PRESSED, TRANSFERS DATA DISPLAYED ON NUMERICAL DISPLAYS INTO ONS RPU COMPUTER.
13	DISPLAY SWITCH	SELECTS DATA FOR PRESENTATION ON LEFT AND RIGHT NUMERICAL DISPLAYS.

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Controls, Annunciators, and/or Indicators for ONS CDU
Figure 3 (Sheet 2)

R
R
003B

EFFECTIVITY: ALL

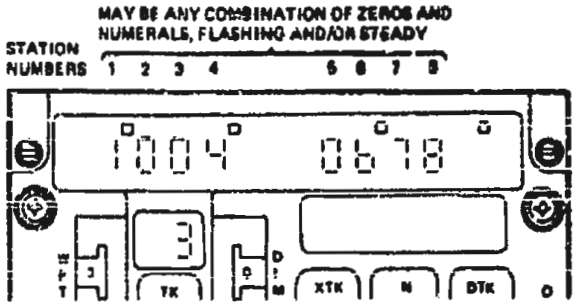
DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY
GMT-DAT PROVIDES WAVE PROPAGATION CORRECTIONS	GREENWICH MEAN TIME IN HOURS AND MINUTES (FROM 0001 TO 2400) TO THE NEAREST MINUTE.	DATE IS THE CALENDAR DATE-MONTH, DAY, YEAR. MONTH-ONE OR TWO DIGITS (1 THRU 12). DAY-TWO DIGITS (01 THRU 31). YEAR-DIGITS ONLY (LAST TWO DIGITS). EX. 030180 = MARCH 1, 1980.
TK-GS	AIRCRAFT TRACK ANGLE MEASURED CLOCKWISE FROM NORTH FROM 0 TO 359.9 DEGREES.	AIRCRAFT VELOCITY RELATIVE TO EARTH'S SURFACE FROM 0 TO 999 KM/HR.
HDG DA	AIRCRAFT HEADING FROM 0 TO 359.9 DEGREES. IF A GRID OFFSET ANGLE (GOA) HAS BEEN ENTERED, INDICATES GRID HEADING.	AIRCRAFT DRIFT ANGLE. INDICATES RIGHT (R) OR LEFT (L) AND 0 TO 39.9 DEGREES.
XTK TKE	AIRCRAFT CROSS-TRACK DISTANCE MEASURED PERPENDICULAR TO DESIRED TRACK. DISPLAYS L OR R AND 0 TO 999.9 NM.	TRACK ANGLE ERROR LEFT OR RIGHT (L, R) OF DESIRED TRACK FROM 0 TO 180 DEGREES.
	NOTE: CROSS-TRACK AND TRACK-ANGLE SHOW ZERO UNTIL A TRACK-ANGLE HAS BEEN INSERTED IN THE FROM/TO WAYPOINT DISPLAY.	
POS ALLOWS ENTRY OF PRESENT POSITION.	INDICATES LATITUDE OF AIRCRAFTS PRESENT POSITION.	INDICATES LONGITUDE OF AIRCRAFTS PRESENT POSITION.
	NOTE: WITH THE DISPLAY SWITCH IN POS AND HLD PRESSED, THE DISPLAY OF PRESENT POSITION LATITUDE AND LONGITUDE IS FROZEN. THIS DOES NOT STOP POSITION COMPUTATION IN THE COMPUTER BUT IS A CONVENIENT WAY OF POSITION REPORTING.	
WPT INDICATES POSITIONS ALONG IN-FLIGHT ROUTE	LATITUDE OF UP TO NINE STORED WAYPOINTS CORRESPONDING TO DIGIT ON WAYPOINT SWITCH.	LONGITUDE OF UP TO NINE STORED WAYPOINTS CORRESPONDING TO DIGIT ON WAYPOINT SWITCH.
DIS-TIME	DISTANCE-TO-GO, FROM 0 TO 9999 NM, TO WAYPOINT CURRENTLY SELECTED FOR NAVIGATION.	TIME-TO-GO, FROM 0 TO 999.9 MINUTES, AND ASSUMES A GROUND SPEED OF 480 KNOTS AT TRUE AIRSPEEDS LESS THAN 110 KNOTS.
	NOTE: DISTANCE-TO-GO AND TIME-TO-GO ARE BLANK UNTIL TRACK LEG IS INSERTED IN THE FROM/TO WAYPOINT DISPLAY.	
WIND	WIND DIRECTION FROM 0 TO 359 DEGREES.	WIND VELOCITY FROM 0 TO 399 KNOTS.
	NOTE: WIND DIRECTION IS DIRECTION WITH RESPECT TO NORTH, MEASURED CW FROM NORTH.	

M1-0000-34-4433

CR Controls, Annunciators, and/or Indicators for ONS CDU
CR Figure 3 (Sheet 3)

R EFFECTIVITY: ALL
R
003B

DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY
DTK STS	COMPUTE DESIRED TRACK-ANGLE BETWEEN SELECTED WAYPOINTS, SHOWN IN THE FROM/TO DISPLAY, FROM 0 TO 359.9 DEGREES. DTK INDICATES 0 UNTIL A TRACK LEG IS INSERTED IN THE FROM/TO DISPLAY.	STATUS CODES (FIGURE 28) AND ACTION/MALFUNCTION CODES (FIGURE 101) ARE BOTH DISPLAYED IN RIGHT DISPLAY.
MH TAS	AIRCRAFT HEADING MEASURED CLOCKWISE FROM MAGNETIC NORTH TO THE AIRCRAFT'S LONGITUDINAL AXIS.	VALUE OF THE CURRENT FILTERED SYNCHRO INPUT FROM AN EXTERNAL DATA SOURCE OR THE DISPLAY OF A MANUALLY ENTERED VALUE. IF THE TAS HAS BEEN MANUALLY ENTERED IN RESPONSE TO AN ACTION CODE 2 (ABOVE), THE MAN ANNUNCIATOR WILL BE LIT UNTIL ALL MANUAL ENTRIES HAVE BEEN ZEROED OUT BY THE OPERATOR.
STA	CURRENT STATUS OF ALL EIGHT OMEGA STATIONS AS SHOWN BELOW. SEE FIGURE 22 FOR STATIONS LOCATIONS.	



NUMERAL ON STEADY = STATION IN USE
NUMERAL FLASHING = STATION AVAILABLE, NOT IN USE NOW
ZERO ON STEADY = STATION AUTOMATICALLY DESELECTED
ZERO FLASHING = STATION MANUALLY DESELECTED

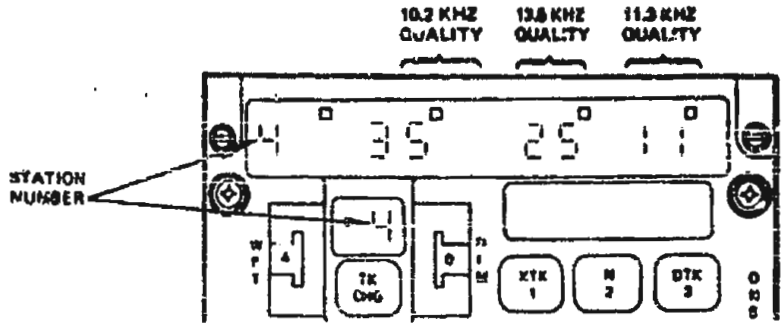
NOTE: STATION STATUS DISPLAYS WILL ALL BE ZEROS UNTIL STATUS 30 HAS BEEN COMPLETED.

M1-0000-34-4434

CR Controls, Annunciators, and/or Indicators for ONS CDU
CR Figure 3 (Sheet 4)

R EFFECTIVITY: ALL
R
003B

DISPLAY SWITCH POSITION	FUNCTION (INDICATION)	
	LEFT DISPLAY	RIGHT DISPLAY
STA (CONT)	STATION SIGNAL QUALITY IS OBTAINED BY PRESSING KEYBOARD PUSHBUTTONS 1 THROUGH 8.	



ALL THREE FREQUENCIES FOR A STATION MUST BE BETWEEN 12 AND 40 FOR STATION QUALITY TO BE CONSIDERED USEFUL.

TO OBTAIN SIGNAL-TO-NOISE RATIO (SNR) IN DB, SUBTRACT 20 FROM DISPLAYED STATION SIGNAL QUALITY.

AN INDICATION OF 00/06 ON ALL FREQUENCIES INDICATES THIS LOCATION IS BEING USED FOR ANTENNA CALIBRATION.

AUX — BY SETTING WPT THUMBWHEEL TO THE APPROPRIATE NUMBER, THE FOLLOWING FUNCTIONS ARE AVAILABLE:

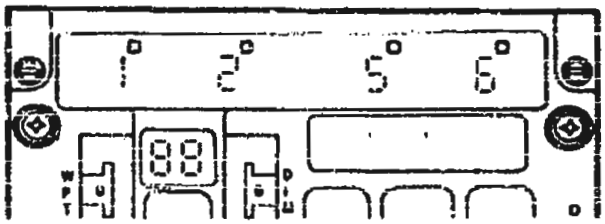
WPT	FUNCTION
0	RELAMING PRESS 0 PRESS ENT
1	GS/DA ENTRY
2	SCRATCH MEMORY
3	STATION FREQUENCIES BEING USED (10.2 13.6, 11.3 kHz)
4	SPARE
5	VLF STATION STATUS. SEE FIGURE 2 FOR STATIONS LOCATIONS.

M1-0000-34-4435

CR CR Controls, Annunciators, and/or Indicators for ONS CDU
Figure 3 (Sheet 5)

R EFFECTIVITY: ALL
R
003B

ITEM NO.	NOMENCLATURE	FUNCTION
	6	SPARE
	7	SPARE
	8	SPARE
	9	LAMP TEST



NOTE: A FLASHING STATION NUMBER INDICATES THE RPU COMPUTER IS EVALUATING STATION SIGNAL QUALITY FOR USE IN NAVIGATION COMPUTATION.

14	MODE SWITCH	SELECT ONS OPERATING MODE AS FOLLOWS:

SET TO	MODE
OFF	NONOPERATING; ALL POWER REMOVED FROM ONS.
A	AUTOPILOT OPERATION; WITH ONS TIED TO AUTOPILOT, AIRCRAFT AUTOMATICALLY SWITCHES TO NEXT TRACK LEG AT WAYPOINTS AND PERMITS MANUAL OVERRIDE.
M	MANUAL OPERATION; OPERATOR ACTION REQUIRED BEFORE AIRCRAFT SWITCHES TO NEXT TRACK LEG AT WAYPOINT
R	ENABLES REMOTE RANGING OPERATION.

15	TK CHG PUSHBUTTON	PROVIDES FOR ENTRY OF INITIAL TRACK LEG AND ALLOWS MANUAL TRACK LEG SWITCHING
16	WAYPOINT (WPT)	WHEN THE DISPLAY SWITCH (13) IS SET TO WPT, THE SWITCH SELECTS WAYPOINTS 1 THROUGH 9 FOR PRESENTATION OF WAYPOINT COORDINATES ON LEFT (2) OR RIGHT (3) DISPLAYS.
17	FROM/TO WAYPOINT	DISPLAYS FROM AND TO WAYPOINT NUMBER OF TRACK LEG BEING NAVIGATED OR POSITION OF WAYPOINT SWITCH WHEN WPT OR AUX IS SELECTED ON DISPLAY.

M1-0009-34-4438

CR Controls, Annunciators, and/or Indicators for ONS CDU
CR Figure 3 (Sheet 6)

R EFFECTIVITY: ALL
R
003B

CR These fields are stronger near high powered motors and heating
CR element than small lights or control circuits. Four hundred Hz
CR circuits are particularly troublesome because of the harmonic
CR relationship of the 400 Hz and the Omega fundamental frequency
CR 13.6 kHz.

CR As a practical matter, any change in the electrical
CR configuration of the aircraft and the selected Omega antenna
CR location should be evaluated carefully by engineering. Due
CR regard to external power generating equipment and its proximity
CR to the Omega antennas should also be given, as the aircraft
CR antenna site was selected without a 90 KVA power cart operating
CR next to the nose of the aircraft.

CR Principals aircraft systems and indicators that are connected to
CR the ONS are listed below:

CR AC Power System (24-22-00)

CR Central Air Data Computer System (34-14-00)

CR Auto Flight Systems (22-00)

CR Magnetic Heading Reference System (MHRS) (34-22-00)

CR Attitude Director Indicator (ADI)

CR Horizontal Situation Indicator (HSI)

CR Power, true air speed and heading are the only electrical inputs
CR required by the ONS from the aircraft. External inputs to the
CR Omega Navigation System are the composite Omega format received
CR from the Omega ground stations and or the VLF low frequency Navy
CR communications stations.

CR Three (3) types of four hundred (400) cycle AC power are
CR required for the aircraft from the aircrafts electrical system.
CR These are 115 volts, 26 volts, variable from 0 to 5 volts. The
CR 0 to 5 volts is used for panel lighting or the control display
CR unit, located in the forward center pedestal. The 26 volts is
CR used in the receiver processor for excitation of signals output.
CR The 115 volts supplies all other requirements in normal
CR operation. True air data computer is used for the determination
CR of wind, speed and direction. In Omega the true air speed is
CR also used as a radiating component for stabilization of ground
CR speed. Next, heading from the Magnetic Reference System is
CR utilized to provide an antenna steering stabilization signal to
CR enable the Receiver Processor to select which antenna loop pair
CR is optimum for the incoming Omega signal.

CR 4. Operational Summary

CR Complete detailed operating procedures for the OMEGA Navigation
CR system are presented in paragraphs 5 through 24 of this
CR document. A short summary is presented in this section as an
CR overview of the normal system operation. The operation steps
CR should be performed in the following manner:

CR A. Set CDU display selector switch to GMT/DAT. CDU displays
CR will indicate normal test pattern for approximately five
CR seconds. This display test can be manually terminated by
CR pressing the clear pushbutton.

CR B. Enter GMT and date.

CR C. Set display selector switch to POS.

CR D. Enter present position.

CR E. Set display selector switch to WPT. Set WPT selector switch
CR to 1 and enter first desired waypoint. Repeat this
CR operation for additional waypoints by advancing WPT selector
CR to the next number.

CR F. Enter initial track leg.

CR G. Check system status to verify operation by setting display
CR selector switch to DTK/STS to read status code.

CR 5. Predeparture Procedures

CR The LTN-211 automatically initiates a self-test sequence
CR followed by automatic synchronization with the OMEGA/VLF
CR transmissions whenever the system is activated. Present
CR position, time, and date must be entered by the operator prior
CR to departure to initialize the system. True airspeed and
CR magnetic heading inputs from the aircraft must also be provided
CR for proper operation.

CR 6. Time and Data Entry

CR The time (GMT), month, day, and year must be entered into the
CR OMEGA digital computer before propagation correction values can
CR be calculated. Enter date and time as follows: Set display
CR selector switch to GMT/DAT and press GMT pushbutton on data
CR keyboard. Starting with the most significant digit, enter the
CR time of day (GMT) by pressing corresponding pushbutton data
CR keyboard. Time is entered in hours and minutes. As each
CR pushbutton is pressed, verify that the corresponding digit is
CR displayed on left numerical display as least significant digit

CR and that each preceding digit moves one place to left. Verify
CR that time is correct and press ENT pushbutton. Press DAT
CR pushbutton on data keyboard. Starting with most significant
CR digit, enter month, day and year by pressing corresponding
CR pushbuttons on data keyboard. As each pushbutton is pressed,
CR verify that the corresponding digit is displayed on right
CR numerical display as least significant digit and that each
CR preceding digit moves one place to the left. Verify that the
CR date is correct and press ENT pushbutton.

CR 7. Present Position Entry

CR The display select switch on the CDU is moved to POS (present
CR position). Present position latitude is entered from the data
CR entry keyboard by first pressing N or S for north or south
CR latitude, then the most significant digit to the least
CR significant digit. Pressing the N or S determines that data
CR will be read on the left display and also illuminates the ENT
CR pushbutton. When the numbers are entered, the most significant
CR number will start in the 0.1 minute position and advance to the
CR left as the remaining numbers are inserted. When the correct
CR latitude is displayed, the ENT pushbutton is pressed to load the
CR latitude number into the computer. (The ENT pushbutton will not
CR extinguish until all four initialization parameters have been
CR entered.)

CR After the data has been keyed in, the displayed data should be
CR checked. When the ENT pushbutton is pressed, the data is
CR transferred to the computer, and the display then reads directly
CR from the computer. Rechecking confirms that an error did not
CR occur during the data transfer.

CR Present position longitude is entered in the same manner as
CR latitude except that E or W for east or west longitude is
CR depressed first. Pressing E (or W) determines that the data
CR will be read on the right display. The number is then entered
CR on the keyboard and inserted in the computer by pushing the ENT
CR pushbutton. The ENT will extinguish.

CR 8. Waypoint Coordinate Entry

CR Waypoint latitude and longitude are entered in a similar manner
CR as present position except that the display selector switch is
CR moved to the WPT (waypoint) position, and the waypoint
CR thumbwheel should be set to the proper waypoint number (1
CR through 9).

CR 9. Initial Track

CR The initial track is the direct great-circle route between the
CR aircraft's present position and the initial enroute waypoint.
CR The pilot must select and initiate the initial track. An
CR initial track represents the route from the aircraft's present
CR position at the time of entry to the first waypoint.

CR 10. Station Deselection

CR An OMEGA station or stations may be declared unusable for
CR navigation. In this event, the station or stations may be
CR deselected for use in the following manner:

CR A. Set the display selector switch to STA. Press the STA
CR pushbutton followed by the data keys (1 through 8)
CR corresponding to the station or stations desired to be
CR deselected for use and press ENT. Manually deselected
CR stations will be indicated by a flashing zero.

CR B. To reselect a station that has been deselected, simply press
CR the STA pushbutton and the corresponding data keys and ENT
CR pushbutton and the digital will reappear indicating they are
CR now available for use (change from flashing to solid).
CR Deselection and reselection of VLF stations is accomplished
CR in a similar manner except that the display selector switch
CR is set to AUX and the WPT thumbwheel is set to 5 prior to
CR pressing the data keys and ENT.

CR 11. Predeparture Indications

CR The LTN-211 provides indicators to annunciate the operational
CR status of the system. The function of these indicators during
CR predeparture is as follows:

CR ENT Pushbutton - Upon termination of the 5 second power on
CR CDU display test, the ENT pushbutton will be illuminated to
CR indicate initialization parameters must be entered. The
CR pushbutton will remain illuminated until initialization is
CR complete.

CR 12. In-Flight Operation

CR During flight, the OMEGA navigation system provides two types of
CR operation relative to track leg navigation, manual or automatic.
CR The system provides identical navigational data in either the
CR automatic or manual position of the CDU mode switch. The terms
CR manual and automatic apply only to track selection, and have no
CR relationship to aircraft control. In automatic operation, the

CR system navigates through each preselected waypoint in sequence,
CR automatically changing track at each waypoint. In manual
CR operation, the pilot must activate each track change. CDU
CR display selection and waypoint position entry may be
CR accomplished in either automatic or manual.

CR 13. Automatic Operation

CR In automatic mode, the change to the next sequential track leg
CR at each waypoint is initiated automatically by the LTN-211. Two
CR minutes before reaching each waypoint the ALERT annunciator
CR comes on and goes out when the track leg change is made. The
CR to/from display automatically changes to show the new track.
CR Place the system in automatic operation by setting the MODE
CR switch to A. As track leg changes are made, verify new desired
CR track for reasonableness. A manual track change override
CR feature is provided.

CR 14. Manual Operation

CR Manual mode is used for track leg defined by nonsequential
CR waypoints, track changes, waypoint bypassing and waypoint
CR change. In manual the ALERT annunciation will flash to indicate
CR a track leg change is required.

CR 15. Track Leg With Nonsequential Waypoints

CR The pilot may manually initiate a track between any two
CR waypoints or track from aircraft present position to any
CR waypoint. With the CDU mode switch set to M, the TK CHG
CR pushbutton is pressed and the "from" and "to" waypoints of the
CR desired track leg are entered on the data keyboard. The entry
CR is shown on the to/from waypoint display. To activate the
CR track, the ENT pushbutton is pressed. Immediately upon pressing
CR ENT, the system navigational data are computed with respect to
CR the new track leg.

CR By selecting 0 as the "from" waypoint, the track is established
CR at the time ENT is pressed from the aircraft present position to
CR the selected "to" waypoint.

CR Present position coordinates are automatically transferred to
CR WPT 0 when ENT is pressed and no data keyboard entry is
CR necessary. Recall of the zero waypoint may be made at any time
CR by selecting WPT on the CDU display selector switch and zero on
CR the waypoint selector thumbwheel.

CR 16. Waypoint Bypassing

CR The pilot may establish a track between any pair of waypoints; i.e., 4 and 7, thus bypassing the in between waypoints; i.e., 5 and 6. If one of the waypoints to be bypassed is the next waypoint, the track change may be initiated from present position.

CR 17. Waypoint Change

CR The pilot may change the coordinates of one or more waypoints for two reasons: to change position of future waypoints and/or to use past waypoints as future waypoints. Waypoint position entry is accomplished as previously described. If waypoint 1, enter future waypoint sequentially, 1 through the last number used, as automatic track leg switching sequences from WPT 9 back to WPT 1.

CR In addition to the normal waypoint coordinate data insertion procedure, an edit feature for waypoint storage is also provided.

CR To edit the waypoint storage sequence, the following procedure must be used. Set display selector switch to WPT and press the HLD pushbutton. The HLD pushbutton will illuminate. Set the waypoint thumbwheel to the desired waypoint number. Key in the desired waypoint coordinates. Note that both LAT and LONG must be entered during the edit procedure. The procedure will cause the new coordinates to be entered into the selected location. The coordinates previously stored at that location and all other locations above will be shifted up one in the sequence. The original waypoint 9, if listed, will be dropped.

CR 18. Position Check

CR At any time during flight, the LTN-211 present position may be compared with a position fix obtained by other means. At the time of fix, position is noted, the CDU HLD pushbutton is pressed to freeze the position display. The display selector is set to POS and the system latitude and longitude at the time of pressing HLD are displayed on the left and right numerical displays, respectively, press HLD again to return to display of correct present position.

CR 19. Track Hold

CR With the desired track hold feature, the pilot may initiate a fixed angle track from the aircraft present position. The CDU display selector is set to DTK/STS. The DTK key on the data

CR keyboard is pressed and the desired track angle to the nearest
CR tenth of a degree is entered. The track angle is shown on the
CR left numerical display. To activate the track, the ENT
CR pushbutton is pressed. All navigational parameters will be
CR computed relative to the position of the aircraft when ENT was
CR pressed. A "99" will be displayed in the to/from display. To
CR exit the track hold mode, simply select DTK/STS, press the DTK
CR Key and then press ENT.

CR 20. Manual Wind Entry

CR When in the DR mode an extended period of time, it may become
CR necessary to manually update wind direction and/or velocity.
CR This can be accomplished by setting the display selector switch
CR to WIND. For a manual velocity entry press R then starting with
CR the most significant digit, key-in velocity and press ENT.

CR NOTE: A manual entry of wind should not be made if the LTN-211
CR is in the OMEGA/VLF navigation modes; manual entry of
CR wind in these modes could affect navigational accuracy.

CR 21. Station Status

CR Since OMEGA/VLF navigation is dependent on ground-based
CR transmitting stations, it is desirable that the operator know
CR the status of the system with respect to these stations.

CR The station status display function tells the operator the
CR stations available for use, which stations are in use and
CR stations that have been deselected for use. To display OMEGA
CR station status set the display selector switch to STA.

CR The associated OMEGA station numbers are displayed as depicted
CR in the diagram on page 11-A.

CR Status of active VLF stations being used are displayed by
CR setting the CDU display selector switch to AUX and WPT
CR thumbwheel to 5.

CR When operating in the OMEGA navigation mode, the status of all
CR eight stations is displayed. The digits on solid are the
CR stations being used for navigation by the computer. Flashing
CR digits represent those stations available but not being used.
CR Zero digits are stations that have been manually deselected by
CR the operator.

CR When operating in the VLF navigation mode, only four of nine
CR stations that have been computer-selected for use are displayed.
CR The station numbers are displayed as solid digits. These
CR computer-selected stations may be manually deselected by the

CR operator and an alternate station selected either manually or
CR automatically by the computer. When an alternate station is
CR manually selected, the station number will appear as flashing,
CR indicating that the computer is determining suitability of the
CR station for use. If the computer determines that the station
CR quality index is suitable, the digit will change from flashing
CR to steady. If the station quality is found unacceptable, the
CR digit will continue to flash. In this case, another station
CR must be selected, either manual or by the computer.

CR 22. Power Interrupts

CR The LTN-211 is designed to retain all essential data to resume
CR automatic operation after a power loss of up to seven minutes.
CR The retained data are GMT and Date, Present Position, Waypoint 0
CR to 9, Track Leg, Deselected Stations, Wind Manually Entered
CR Heading, TAS or wind Current Propagation Corrections.

CR If the interrupt is less than seven seconds in duration, the
CR system automatically continues operation with no pilot action
CR required. The event would be noted by a short duration DR
CR annunciator illumination and the presence of a STA 60 or 30
CR indication (right display). Status 01 will be resumed within
CR three minutes.

CR If the interruption is greater than seven seconds and less than
CR seven minutes, pilot action is required. Upon the return of
CR power, the following displays will be present:

CR A. Display of GMT and date which had been frozen at the instant
CR of the power interrupt.

CR B. Display of present position frozen at the same instant.

CR C. A DR annunciation.

CR D. A flashing WARN annunciation.

CR E. The HOLD pushbutton illuminated.

CR F. An action code 65 (left half of right display) and STA 60 or
CR 30 (right half of right display) is present.

CR The required pilot action is:

CR A. Update GMT. Normal advancement should be noted.

CR B. Update Date if required.

CR C. If estimated present position has changed by more than 32 nm
CR since the power interruption, update present position.

LOCATIONS OF OMEGA AND VLF TRANSMITTERS

STATION DESIGNATION	LOCATION	LATITUDE	LONGITUDE
	OMEGA STATIONS		
1 (A)	NORWAY	66° 25.2' N	13° 08.3' E
2 (B)	LIBERIA	6° 19.3' N	10°20.8' W
3 (C)	HAWAII	21° 24.3' N	157° 49.9' W
4 (D)	NORTH DAKOTA	46° 21.8' N	98° 20.1' W
5 (E)	LA REUNION	20° 58.5' S	55° 17.4' E
6 (F)	ARGENTINA	43° 12.2' S	65° 11.5' W
7 (G)	AUSTRALIA*	38° 28.8' S	146° 56.1' E
8 (H)	JAPAN	34° 36.9' N	129° 27.2' E
	VLF STATIONS		
1	NORWAY	67° 04.0' N	14° 04.0' E
2	ENGLAND (RUGBY)	52° 22.2' N	01° 11.9 W
3	HAWAII	21° 25.5' N	158° 09.3 W
4	U.S. (WASHINGTON STATE)	46° 12.3' N	121° 54.0' W
5	U.S. (MARYLAND)	38° 58.1' N	76° 27.2' W
6	U.S. (MAINE)	44° 30.8' N	67°16.2' W
7	AUSTRALIA	21° 49.0' S	114° 08.8' E
8	JAPAN	34° 58.2' S	137° 01.3' E
9	ENGLAND (ANTHORNE)	54° 54.0' N	03° 16.4 W

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CR
CR

Locations of Omega and VLF Transmitters
Figure 4

R
R
003B

EFFECTIVITY: ALL

CR D. Press HOLD. HOLD annunciator will extinguish and present
CR position will advance and the flashing WARN will extinguish.

CR E. Monitor STS observing that the system cycles down to 01 and
CR the DR annunciator extinguishes in approximately three
CR minutes.

CR 23. Back-Up Operations

CR The LTN-211 requires both true airspeed and heading as inputs
CR from the aircraft. In the event that one of these inputs is
CR lost during flight, these values may be manually entered and
CR updated as a backup mode of operation.

CR For manual entry, set display selector switch to MH/TAS, press
CR the L pushbutton for M HDG of the R pushbutton for TAS. Key-in
CR desired data (HDG, left display; TAS, right display). Press
CR ENT. Update inserted values as required.

CR 24. Post-Flight Operation

CR After a flight is completed the LTN-211 may be left in the
CR Navigate mode if the landing is an intermediate stop and another
CR flight leg will be made. When shutdown is desired, pull the
CR mode switch away from the panel and set to OFF.